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THE CEPHALOPODS

OF THE

NORTHEASTERN COAST OF AMERICA.

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BY

A. E. VERRILL.

[EXTRACTED FROM THE ANNUAL REPORT OF THE COMMISSIONER OF FISH AND FISHERIES FOR 1879.]

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000.—REPORT ON THE CEPHALOPODS OF THE NORTHEASTERN COAST OF AMERICA.

By A. E. Verrill.

Part I.—The gigantic squids (*Architeuthis*) and their allies; with observations on similar large species from foreign localities.

The early literature of natural history has, from very remote times, contained allusions to huge species of Cephalopods, often accompanied by more or less fabulous and usually exaggerated descriptions of the creatures* In a few instances figures were attempted which were largely indebted to the imagination of their authors for their more striking peculiarities.

In recent times, many more accurate observers have confirmed the existence of such monsters, and several fragments have found their way into European museums.

To Professor Steenstrup and to Dr. Harting, however, belongs the credit of first describing and figuring, in a scientific manner, a number of fragments sufficient to give some idea of the real character and affinities of these colossal species. More particular accounts of the specimens described by these and other recent writers will be given farther on.

Special attention has only recently been called to the frequent occurrence of these "big squids," as our fishermen call them, in the waters of Newfoundland and the adjacent coasts. The cod-fishermen, who visit the Grand Banks, appear, from their statements, to have been

*The description of the "poulpe" or devil-fish, by Victor Hugo, in "The Toilers of the Sea," with which so many readers have recently become familiar, is quite as fabulous and unreal as any of the earlier accounts, and even more *bizarre*. His description represents no real animal whatever. He has attributed to the creature habits and anatomical structures that belong in part to the *polyps* and in part to the *poulpe* (*Octopus*), and which appear to have been derived largely from the several descriptions of these totally distinct groups of animals, contained in some cyclopedia. These he has confounded and hopelessly mixed up. As if to make this confusion worse confounded, he applied to his creation the name of "*Cephaloptera*," the designation of a gigantic genuine fish (a "ray") found on our southern coasts, and also called "devil-fish" by the fishermen. His account of the *general appearance* of the *Octopus*, however, is not so bad, and was evidently based on a very superficial personal examination of an ordinary specimen of *Octopus vulgaris*.

long familiar with them, and occasionally to have captured and used them for bait. The whalemen have also repeatedly stated that sperm-whales feed upon huge squid, and that, when wounded, they often vomit large fragments of them, in such a condition as to be recognizable.*

I have somewhere seen a statement to the effect that a huge squid of this kind was cast ashore, many years ago (in the last century, I believe), at the Island of St. Pierre, near Newfoundland, but have forgotten the authority for the statement.

The first reliable account, known to me, of specimens actually taken in American waters by our fishermen and whalemen was published by Dr. A. S. Packard, in 1873.† In that article Dr. Packard described a portion of a jaw from a large specimen (our No. 1) taken by the Gloucester fishermen on the Grand Banks, and a very large pair of jaws taken from the stomach of a sperm-whale (our No. 10). Soon after this, in 1873, a large living specimen (our No. 2) was encountered by Theophilus Picott and another fisherman, in Conception Bay, and one of the tentacular arms which they secured was preserved in the geological museum at Saint John's, Newfoundland, by the Rev. M. Harvey and Mr. Alexander Murray. Both these gentlemen wrote good and interesting accounts of this specimen, which were extensively copied in the magazines and newspapers, while a photograph of the arm itself was also secured and distributed.

This important addition to our knowledge of these creatures was followed, about two weeks later, by the capture of a nearly perfect specimen (our No. 5) of the same species, near Saint John's. Mr. Harvey and Mr. Murray likewise secured this specimen, and published detailed accounts of it, which gave a more accurate idea of the character of the genus and species than had any previous descriptions.

My own attention was specially directed to these large Cephalopods, at that time, on account of being so fortunate as to secure for study most of the preserved portions of all the specimens referred to above, with some additional ones, detailed below. For these very interesting specimens I am especially indebted to the zeal and kindness of the Rev. M. Harvey and to Prof. S. F. Baird. To Dr. A. S. Packard I am indebted for the use of the jaws of No. 10. Mr. Pourtalès, curator of the Museum of Comparative Zoology, has also kindly sent the specimens belonging to that museum, and Mr. W. H. Dall has contributed his specimens and drawings of a species from Alaska. Special acknowledgments to others will be found in connection with the descriptions of the specimens.

Although I have, in several former papers,‡ given details of the time

* See Maury's Sailing Directions. Also articles by N. S. Shaler, American Naturalist, vol. vii, p. 3, 1873; by Dr. Packard, op. cit., p. 90; and by Mr. W. H. Dall, op. cit., p. 484.

† American Naturalist, vol. vii, p. 91, February, 1873.

‡ American Jour. Science, vol. vii, p. 158, Feb., 1874; vol. ix, pp. 123, 177, Plates II-V, 1875; vol. x, p. 213, Sept., 1875; vol. xii, p. 236, 1876; vol. xiv, p. 425, Nov.,

and place of occurrence of many of the specimens enumerated below, it seems desirable to bring together, in this place, accounts of all these, in order that the various descriptions and measurements may be more readily compared, and also that errors in some of the former accounts may be corrected and new information added. To facilitate the comparison of the general accounts of more than twenty-five examples that I am now able to enumerate from our coast, I have given, by themselves, the statements of the time and place of their occurrence, with such general descriptions and measurements of each as are most available, reserving the more detailed special descriptions of the preserved specimens for the systematic part of this article.

This seemed the more desirable because the information concerning many of the specimens is so scanty as to render it impossible to refer them, with certainty, to either of the species now recognized or named. It is probable, however, that only three forms are indicated by the large Newfoundland specimens of *Architeuthis*, and two of these may be merely the males and females of one species. One of the principal differences usually indicated by the measurements is in respect to the size and length of the shorter arms, one form having them comparatively stout, often "thicker than a man's thigh," while the other form has them long and slender (usually 3 to 5 inches in diameter, with a length of 6 to 11 feet). In case these differences prove to be sexual, those with stout arms will probably be the females, judging from analogy with the small squids nearest related.* In the three specimens, of which I have seen the arms, they are long and slender, but in one the arms are much longer in proportion to the body than in the others; there are also differences in the denticulation of the suckers of the short arms. These differences appear, at present, to indicate two species.

A few words of explanation may be desirable here, in regard to the relative value of the measurements usually given, and also with reference to the parts most useful to preserve when, as will usually happen, the whole

1877. American Naturalist, vol. viii, p. 167, 1874; vol. ix, pp. 21, 78, Jan. and Feb., 1875 Annals and Magazine of Nat. Hist., March, 1874. Transactions Connecticut Acad. Science, vol. v, p. 177, Plates XIII–XXV, 1879–'80.

*By examinations of very numerous specimens of our common squids, *Ommastrephes illecebrosus* and *Loligo Pealei*, I have satisfied myself that the adult females of both commonly differ from the males by having the head, the siphon, the arms, and the suckers relatively larger and stronger than in the males. In comparing specimens of the two sexes having the body and fins of the same length, this difference is often very evident. The large suckers of the tentacular arms often show an increased size in the female, in a very marked degree. The short arms show a greater increase in diameter than in length. In one of my former articles (Amer. Journ. Sci., ix, p. 179, 1875) the increase in size of these parts was erroneously, but inadvertently, said to be in the male, but this error has been corrected in my subsequent articles. Still, it is true that both sexes vary to a considerable extent in the size of the suckers, even in adult specimens of equal size, so that a male may easily be selected with suckers larger than those of some females of the same size. In these common squids I have found no great variation in the relative size and form of the caudal fins, when adult, and of the same sex. I have often found the males more common than the females.

cannot be saved. The measurements of the soft external parts of Cephalopods are, for the most part, only approximate, and they are not all of equal value, for some parts are more changeable in size and shape than others. The long, contractile tentacular arms, especially, are liable to great variation in length according to their state of contraction or extension, and therefore their relative length is of little or no value in discriminating species. Unfortunately, this, either by itself or combined with the length of the 'body' as total length, is often the principal one given. The circumference of the body varies, likewise, according to its state of contraction or relaxation, and the 'breadth' of the body, when such soft creatures are stranded on the shore, will depend much upon the extent to which it is collapsed and flattened from its proper cylindrical form, and is of less value than the circumference. Measurements of the length of the body, to the mantle-edge, and to the bases of the arms; length and circumference of the various pairs of short arms; of the length and circumference of the head; size of the eyes; length and breadth of the tail-fin; size of the largest suckers on the different arms; and size of the 'club' of the long arms, are all very useful and valuable. The shape of the tail-fin should be carefully noted, also the presence or absence of eyelids, and of a sinus or groove at the front edge of eyelids. The size and shape of the thin internal 'bone' or 'pen' is particularly desirable. All parts of Cephalopods contract to a very great extent, when preserved in strong alcohol for some time. Even the horny jaws and sucker-rings may decrease as much as 20 per cent. in size, and the soft parts much more. Usually it will not be possible to preserve the pen in any satisfactory shape by drying, for it cracks in pieces and curls up. It may be preserved packed in salt, in brine, or in alcohol. The same is true of the beak. The horny rims of the suckers can usually be dried, but are better by far in alcohol or brine. The parts most useful for preservation in alcohol or salt, in cases when only a portion can be saved, are the long tentacular arms, especially their terminal 'clubs,' with the suckers in place; the short arms, with their suckers; of these the left arm of the lower, or ventral, pair will probably be the most valuable, being usually the one that will show the sexual distinction, by the alteration of its suckers, toward the tip or in some other part; the lateral arms next to the ventral are next in importance; the caudal fin, and if possible the entire head, should be preserved; also the 'pen,' if possible. In cases where the head cannot be saved entire, even with the arms removed, the beak and tongue, and other fleshy parts in and behind the beak, should be carefully preserved, as nearly entire as possible, either in strong brine or in alcohol of not less than 80 per cent., which is generally the best strength for all kinds of Cephalopods.

General description of the several American specimens, and of their occurrence.

No. 1.—Grand Banks specimen, 1871. (*Architeuthis princeps.*)

Plate XI, figures 3, 3*a*.

This specimen was found dead and floating at the surface, on the Grand Banks of Newfoundland, in October, 1871, by Captain Campbell, of the schooner "B. D. Haskins," of Gloucester, Mass. It was taken on board and part of it used for bait.* Dr. A. S. Packard has given, in the American Naturalist, vol. vii, p. 91, February, 1873, a letter from Mr. James G. Tarr, of Gloucester, Mass., containing most of the facts that have been published in regard to the history of this individual. But its jaws were sent to the Smithsonian Institution by Mr. G. P. Whitman, and were sent to me by Professor Baird to be described and figured. The horny jaw or beak from this specimen is thick and strong, nearly black; it is acute at the apex, with a decided notch or angle on the inside, about .75 of an inch from the point, and beyond the notch is a large, prominent angular lobe. Mr. Tarr states that the mate of the vessel measured the body of this specimen with a rule, after it was hoisted on board, and that it measured 15 feet in length and 4 feet 8 inches in circumference. The arms were mutilated, but the portions remaining were estimated to be 9 or 10 feet long and 22 inches in circumference, two being shorter than the rest. It was estimated that it weighed 2,000 pounds, and would have filled eight or ten barrels.

No. 2.—Conception Bay specimen, 1873. (*Architeuthis Harveyi?*)

A large individual, seen resting at the surface, was approached and attacked by two men, who were in a small boat, near Portugal Cove, in Conception Bay, October 27, 1873. Full accounts of this adventure, written by Rev. M. Harvey, have been published in many of the magazines and newspapers.† Two of the arms, which it threw across the boat, were cut off with a hatchet and brought ashore. One of these was a short or sessile arm, the other was one of the long, slender tentacular

* I have been informed by many other fishermen that these "big squids," as they call them, are occasionally taken on the Grand Banks and used for bait. Others state that they have seen them in that region, without being able to capture them. Nearly all the specimens hitherto taken appear to have been more or less disabled when first observed, otherwise they probably would not appear at the surface in the day-time. From the fact that they have mostly come ashore in the night, I infer that they inhabit chiefly the very deep and cold fiords of Newfoundland, and come up to the surface only in the night.

† See Amer. Jour. Science, vol. vii, p. 158, 1874; and Amer. Naturalist, vol viii, No. 2, p. 120, Feb., 1874, in a letter from Mr. Alexander Murray. Also, Proc. Zool. Soc. Lond., p. 178, 1874; Proc. Boston Soc. Nat. Hist., xvi, p. 161, 1873; The Maritime Monthly, iii, No. 3, March, 1874, p. 193; The New York World, Nov. 9, 1873; The Montreal Gazette, Nov. 26, 1873; The Boston Traveller, Nov., 1873.

arms. A portion of the latter, measuring 19 feet in length, was preserved by the Rev. M. Harvey and Mr. Alexander Murray for the museum at Saint John's, Newfoundland. It was photographed, and cuts copied from the photograph were published in some of the English magazines.* Before it was secured for preservation it had been considerably injured, many of the larger suckers having been torn off or mutilated. Owing to this fact they were originally described by Mr. Harvey as destitute of marginal denticulations, but he subsequently re-examined the specimen, at my request, and informed me that they were all originally denticulated. Of this specimen I have seen only the photograph and some of the smaller suckers. This fragment represents the distal half of one of the long tentacular arms, with its expanded terminal portion or 'club' originally covered with cup-shaped suckers, about 24 of which, forming two central rows, are very large, the largest being 1.25 inches in diameter; others, alternating with these along each margin, are smaller, with the edge supported by a serrated ring. The tip of the arm is covered with numerous smaller suckers, in four rows. The part of the arm preserved measured, when fresh, 19 feet in length and 3.5 inches in circumference, but wider, "like an oar," and 6 inches in circumference near the end, where the suckers are situated.

It is stated that 6 feet of this arm had been destroyed before it was preserved, and the captors estimated that they left from 6 to 10 feet attached to the creature, which would make the total length between 31 and 35 feet. According to Mr. Murray, the portion preserved measured but 17 feet in length when he examined it, October 31, 1873, after it had been a few days in strong brine. The other arm was destroyed and no description was made; but the portion secured was estimated by the Rev. Mr. Gabriel, who saw it, to have been 6 feet long and 10 inches in diameter; it was evidently one of the eight shorter sessile arms, and its size was probably overestimated. The fishermen, who were doubtless somewhat frightened, estimated the body of this individual to have been about 60 feet in length and 5 feet in diameter, according to Mr. Harvey; but if the proportions be about the same as in the specimens since captured (No. 5 and No. 14), as I believe, then the body could not have been more than about 10 feet long and 2.5 feet in diameter, and the long arms should have been about 32 feet in length.† Allowing 2 feet for the head, the total length, would, therefore, be about 44 feet.

The following extract is from a letter written by the Rev. M. Harvey to Dr. J. W. Dawson, and published in the Montreal Gazette, February 26, 1873: "Two fishermen were out in a small punt, on October 26, 1875, off Portugal Cove, Conception Bay, about nine miles from Saint John's.

* See Annals and Magazine of Natural History, IV, xiii, p. 68, Jan., 1874; and The Field, Dec. 13, 1873. The central line of this photograph is reduced four and a quarter times, while the front part is reduced about four times.

† Doubtless these long arms are very contractile, and changeable in length, like those of the ordinary squids.

Observing some object floating on the water at a short distance, they rowed towards it, supposing it to be a large sail or the *débris* of a wreck. On reaching it one of the men struck it with his 'gaff,' when immediately it showed signs of life, reared a parrot-like beak, which they declare was 'as big as a six-gallon keg,' with which it struck the bottom of the boat violently. It then shot out from about its head two huge livid arms and began to twine them round the boat. One of the men seized a small ax and severed both arms as they lay over the gunwale of the boat; whereupon the fish moved off and ejected an immense quantity of inky fluid, which darkened the water for two or three hundred yards. The men saw it for a short time afterwards, and observed its tail in the air, which they declare was 10 feet across. They estimate the body to have been 60 feet in length, 5 feet in diameter, of the same shape and color as the common squid, and they observed that it moved in the same way as the squid, both backwards and forwards.

"One of the arms which they brought ashore was unfortunately destroyed, as they were ignorant of its importance; but the clergyman of the village assures me it was 10 inches in diameter and 6 feet in length. The other arm was brought to Saint John's, but not before 6 feet of it were destroyed. Fortunately, I heard of it and took measures to have it preserved. Mr. Murray, of the geological survey, and I afterwards examined it carefully, had it photographed, and immersed in alcohol; it is now in our museum. It measured 19 feet, is of a pale, pink color, entirely cartilaginous, tough and pliant as leather, and very strong."

No. 3.—Coombs' Cove specimen, 1872. (*Architeuthis Harveyi* ? ?)

Another specimen (No. 3), probably considerably larger than the last, was captured at Coombs' Cove, Fortune Bay, Newfoundland. The following account has been taken from a newspaper article, of which I do not know the precise date,* forwarded to me by Professor Baird, together with a letter, dated June 15, 1873, from the Hon. T. R. Bennett, of English Harbor, Newfoundland, who states that he wrote the article, and that the measurements were made by him, and are perfectly reliable:†

"Three days ago there was quite a large squid run almost ashore at Coombs' Cove, and some of the inhabitants secured it. The body measured 10 feet in length and was nearly as large round as a hogshead. One arm was about the size of a man's wrist, and measured 42 feet in length; the other arms were only 6 feet in length, but about 9 inches in diameter, very stout and strong. The skin and flesh were 2.25 inches

* The exact date of this capture I do not know, but it was probably in the autumn or winter of 1872.

† Through Mr. Sanderson Smith, who visited Mr. Bennett after the publication of my first article, I learn that this specimen is the same as the one designated as No. 6 in my early papers, and that the measurements of No. 6, as given to me by Mr. Harvey, are incorrect, owing to his mistake in supposing that 42 feet was the *total length*, instead of the length of the longer tentacular arm.

thick, and reddish inside as well as out. The suction-cups were all clustered together, near the extremity of the long arm, and each cup was surrounded by a serrated edge, almost like the teeth of a hand-saw. I presume it made use of this arm for a cable, and the cups for anchors, when it wanted to come to, as well as to secure its prey, for this individual, finding a heavy sea was driving it ashore, tail first, seized hold of a rock and moored itself quite safely until the men pulled it on shore."

Mr. Bennett, in a memorandum subsequently given to Mr. Sanderson Smith, and communicated to me by him, states that both the tentacular arms were present, and that the shorter one was 41.5 feet in length. The large diameter of the short arms, compared with their length and with that of the long arms, and their shortness compared with the length of the body, are points in which this specimen apparently differed essentially from those that have been preserved and are better known. It was probably a female. The total length, as I understand the measurements, was 52 feet.

No. 4.—Bonavista Bay specimen. (*Architeuthis Harveyi?*)

Plate III, figures 4, 4*a*. Plate IV, figures 1, 1*a*.

A pair of jaws and two of the suckers from the tentacular arms were forwarded to me by Professor Baird, of the Smithsonian Institution. These were received from Rev. A. Munn, who writes that they were taken from a specimen that came ashore at Bonavista Bay, Newfoundland; that it measured 32 feet in length (probably the entire length, including the tentacular arms) and about 6 feet in circumference. The jaws are large and broad, resembling those of No. 5 both in size and form, but much thinner than those of No. 1, and without the deep notch and angular lobe seen in that specimen. The suckers also agree with those of No. 5, but are a little smaller.

No. 5.—Logie Bay specimen, 1873. (*Architeuthis Harveyi*, type.)

Plate I. Plate II. Plate III. Plate IV, figures 4–11. Plate V, figures 1–5.

A complete specimen was captured in November, 1873, at Logie Bay, about four miles from Saint John's, Newfoundland. It became entangled in a herring-net, and made a desperate effort to escape. It was killed by the fishermen, with some difficulty, and only after a struggle, during which its head was badly mutilated and severed from the body, and the eyes, most of the siphon-tube, and part of the front edge of the mantle were destroyed. It is probable that this was a smaller specimen of the same species as No. 2. Fortunately, this specimen was secured by the Rev. M. Harvey, of Saint John's. After it had been photographed and measured, he attempted to preserve it entire in brine, but this was found to be ineffectual, and after decomposition had begun to destroy some of the most perishable parts, he took it from the brine and, divid-

ing it into several portions, preserved such parts as were still undecomposed in strong alcohol. These various portions have all been examined by me, and part of them are now in my possession, and, with the photographs, have enabled me to present a restoration, believed to be tolerably accurate, of the entire creature (Plate II). In this figure the eyes, ears, siphon-tube, and front edge of the mantle have been restored from a small squid (*Ommastrephes*). The other parts have been drawn directly from the photographs and specimens.* There were two photographs of the specimen,† one showing the entire body, somewhat mutilated anteriorly, the other showing the head with the ten arms attached (Plate I, fig. 1). The photographs were made by Messrs. McKenny & Parsons, of Saint John's. The body or mantle of this specimen was about 7 feet long and between 5 and 6 feet in circumference; the relatively small caudal fin was arrow-shaped and 22 inches broad, but short, thick, and very pointed at the end; the two long tentacular arms were 24 feet in length and 2.5 inches in circumference, except at the broader part near the end; the largest suckers, which form two regular alternating rows, of twelve each, were 1.25 inches in diameter, with serrated edges. There is also an outer row of much smaller suckers, alternating with the large ones, on each margin; the terminal part is thickly covered with small serrated suckers; and numerous small suckers and tubercles are crowded on that portion of the arms where the enlargement begins, before the commencement of the rows of large suckers. The arrangement of the suckers is nearly the same as on the long arm of No. 2, but in the latter the terminal portion of the arm, beyond the large suckers, as shown in the photographs, is not so long, tapering, and acute, but this may be due to the different conditions of the two specimens. The eight short arms were each 6 feet long; the two largest were 10 inches in circumference at base; the others were 9, 8, and 7 inches. These short arms taper to slender, acute tips, and each bears more than 100 large, oblique suckers, with serrated margins, and over 200 smaller ones toward the tip.

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* The figure was originally made, from the photographs only, by Mr. P. Rœtter, of the Museum of Comparative Zoology, but after the arrival of the specimens it had to be altered in many parts. These necessary changes were made by the writer, after a careful study of the parts preserved, in comparison with the photographs and original measurements. As published in my first paper (1875), the eyes and back of the head of the figure were restored as in *Loligo*. Subsequent studies and additional specimens showed that this genus is closely allied to *Ommastrephes*. Therefore, the head would have been more correctly shown had it been restored with reference to that genus, as has been done in this paper. The most obvious difference is in the eyes, which have distinct lids and an anterior sinus.

† Cuts made from these photographs have been published in several magazines and newspapers, but they have been engraved with too little attention to details to be of much use in the discrimination of specific differences. I have, therefore, prepared new figures from these photographs with the greatest care possible (Plate I). These figures are particularly valuable, as showing the arrangement of the suckers on the short arms.

The portions of the pen in my possession belong to the posterior part of the blade, with fragments from the middle; although neither the actual length nor the greatest breadth of this part can be given, we can yet judge very well what its general form and character must have been. It was a large, broad and thin structure, of a yellowish brown color, and translucent. Its posterior portion (Plate III, figure 3) resembles that of *Loligo*, but its anterior and lateral edges are entirely different, for instead of having a regular lanceolate form, tapering to both ends, as in *Loligo*, it expands and thins out toward the lateral and anterior borders, fading out insensibly, both at the edges and end, into soft membrane.* The posterior end, for about an inch and a half, rapidly narrows to a point, which was probably involute and hooded for a short distance; from this portion forward the width gradually increases from 1.2 inches to 5 inches, at a point 25 inches from the end, where our specimen is broken off; at this place the marginal strips are wanting, but the width is 5 inches between the lateral midribs (*d*, *d''*), which were, perhaps, far from the margin. Along the center of the shell there is a strong, raised, smooth, rounded midrib, which is very conspicuous in the middle and posterior sections, becoming angular near the end. On each side of the midrib is a lateral rib of smaller size. These at first diverge rapidly from the central one, and then run along nearly parallel with the outer margin and about .4 of an inch from it, but beyond 11 inches from the point the margins are torn off; the lateral ribs gradually fade out before reaching the anterior border; near the place where they finally disappear they are about 6 inches apart.†

No. 6 (of former articles)—Same as No. 3.

No. 7.—Labrador specimen.

Dr. D. Honeyman, geologist, of Halifax, Nova Scotia, has published, in a Halifax paper, a statement made to him by a gentleman who claims to have been present at the capture of another specimen (No. 7), in the Straits of Belle Isle, at West Saint Modent, on the Labrador side: "It was lying peacefully in the water when it was provoked by the push of an oar. It looked fierce and ejected much water from its funnel; it did not consider it necessary to discharge its sepia, as mollusca of this kind

* Probably there may have been a narrow prolongation or shaft beyond the portion preserved, but of this there is no fragment.

† Mr. Harvey published popular accounts of this specimen, and of the previously captured arm of the larger one (No. 2), in the Maritime Monthly Magazine of Saint John, New Brunswick, for March, 1874, and in several newspapers. Acknowledgments are also due to Mr. Alexander Murray, provincial geologist, who coöperated with Mr. Harvey in the examination and preservation of these specimens, and who has also written some of the accounts of them that have been published. See also the American Naturalist, vol. viii, p. 122, February, 1874; American Journal of Science, vol. vii, p. 460; Nature, vol. ix, p. 322, February 26, 1874; Appleton's Journal, January 31, 1874; Forest and Stream, p. 356 (with figure), January, 1874.

generally do in order to cover their escape. The men in the boat determined to secure it. After it had taken the boat in its arms, they tried to ship it with their oars. One of these broke, but another boat coming to aid in the capture, the squid was taken hold of by a grapnel and rolled into a seine-boat. The boats were engaged in the herring-fishing. This also appears to have been the squid's occupation about the time of its capture. The length of its longest arm was 37 feet; the length of the body 15 feet; whole length 52 feet. The bill was very large. The suckers of its arms or feet, by which it lays hold, about 2 inches in diameter. The monster was cut up, salted, and barreled for dog's meat."

In this account the length given for the "body" evidently includes the head also. This creature was probably disabled, and perhaps nearly dead, when discovered at the surface, and this seems to have been the case with most of the specimens hitherto seen living. Animals of this sort probably never float or lie quietly at the surface when in good health.

Nos. 8 and 9.—Lamaline specimens, 1870–'71.

Mr. Harvey refers to a statement made to him by a clergyman, Rev. A. E. Gabriel, of Portugal Cove, that two specimens (Nos. 8 and 9), measuring respectively 40 and 47 feet in total length, were east ashore at Lamaline, on the southern coast of Newfoundland, in the winter of 1870–'71.

No. 10.—Sperm-whale specimen. (*Architeuthis princeps.*)

Plate XI, figures 1, 2.

This specimen, consisting of both jaws, was presented to the Peabody Academy of Science, at Salem, Mass., by Capt. N. E. Atwood, of Provincetown, Mass. It was taken from the stomach of a sperm-whale, but the precise date and locality are not known. It was probably from the North Atlantic. The upper jaw was imperfectly figured by Dr. Packard in his article on this subject.* It is one of the largest jaws yet known, and belonged to an apparently undescribed species, which I named *Architeuthis princeps*, and described in my former papers, with figures of both jaws.

No. 11.—Second Bonavista Bay specimen, 1872.

The Rev. M. Harvey, in a letter to me, stated that a specimen was east ashore at Bonavista Bay, December, 1872, and that his informant told him that the long arms measured 32 feet in length, and the short arms about 10 feet in length, and were "thicker than a man's thigh." The body was not measured, but he thinks it was about 14 feet long and very stout, and that the largest suckers were 2.5 inches in diameter. The size of the suckers is probably exaggerated, and most likely the

* American Naturalist, vol. vii, p. 91, 1873.

length of the body also. It is even possible that this was the same specimen from which the beak and suckers described as No. 4, from Bonavista Bay, were derived, for the date of capture of that specimen is unknown to me. The latter, however, was much smaller than the above measurements, and it is, therefore, desirable to give a special number (11) to the present one.

No. 12.—Harbor Grace specimen, 1874–'75.

Another specimen, which we have designated as No. 12, was cast ashore, in the winter of 1874–'75, near Harbor Grace, but was destroyed before its value became known, and no measurements were given.

No. 13.—Fortune Bay specimen, 1874.

Plate IX, figure 11.

A specimen was cast ashore, December, 1874, at Grand Bank, Fortune Bay, Newfoundland. As in the case of several of the previous specimens, I was indebted to the Rev. M. Harvey for early information concerning this one, and also for the jaws and one of the large suckers of the tentacular arms, obtained through Mr. Simms, these being the only parts preserved. Although this specimen went ashore in December, Mr. Harvey did not hear of the event until March, owing to the unusual interruption of travel by the severity of the winter. He informed me that Mr. George Simms, magistrate of Grand Bank, had stated in a letter to him that he examined the creature a few hours after it went ashore, but not before it had been mutilated by the removal of the tail by the fishermen, who finally cut it up as food for their numerous dogs; and that the long tentacular arms were 26 feet long and 16 inches in circumference; the short arms were about one-third as long as the long ones; the "back of the head or neck was 36 inches in circumference" (evidently meaning the head behind the bases of the arms); the length of the body "from the junction to the tail" was 10 feet (apparently meaning from the base of the arms to the origin of the caudal fins). He thought that the tail, which had been removed, was about one-third as long as the body, but this was probably overestimated. In No. 14 the tail, from its origin or base, was about one-fifth as long as the balance of the body and head. Applying the same proportions to No. 13, the head and body together would have been 12 feet. In a letter to me, dated October 27, 1875, Mr. Simms confirmed the above measurements, but stated that the long arms had been detached, and that the bases of the arms measured as those of the tentacular arms (they had previously been cut off about a foot from the head), were triangular in outline, the sides being respectively 5, 6, 5 inches in breadth, the longest or outer side being convex and the two lateral sides straight. He, moreover, says that *all* the arms were covered with large suckers *from the base outward.* Hence, it is probable that he made a mistake as to these stumps, and

that they really belonged to a pair of sessile arms. Probably the tentacular arms, when extended, had been cut off so close to their contractile bases that their stumps had afterwards become contracted within their basal pouches, and were therefore overlooked. He adds that the body was 3 feet broad (doubtless it was much flattened from its natural form), and that the measurements were made while the body lay upon uneven ground, so that its exact length could not be easily ascertained, and that the caudal fin had been cut off at its base. As the tail-fins of Nos. 5 and 14 were about one-fifth the length of the rest of the body and the head together, this specimen, if belonging to either of those species, should have been about 12 feet from the base of the arms to the tip of the tail.

The large sucker in my possession is 1 inch in diameter across the denticulated rim, and in form and structure agrees closely with those described and figured by me from the tentacular arms of Nos. 4, 5, and 14 (Plate IV, figures 1, 4, and Plate IX, figures 1, 1 *a*).

The jaws are still attached together, in their natural position, by the cartilages. They agree very closely in form with the large jaws of *Architeuthis princeps* V. (No. 10), figured on Plate XI, but they are about one-tenth smaller.

No. 14.—Catalina specimen, 1877. (*Architeuthis princeps.*)

Plates VIII–X.

A nearly perfect specimen of a large squid was found cast ashore, after a severe gale, at Catalina, Trinity Bay, Newfoundland, September 22, 1877. It was living when found. It was exhibited for two or three days at Saint John's, and subsequently was carried in brine to New York, where it was purchased by Reiche & Brother, for the New York Aquarium. There I had an opportunity to examine it very soon after its arrival.* I am also indebted to the proprietors of the aquarium for some of the loose suckers. Other suckers from this specimen were sent to me from Newfoundland, by the Rev. M. Harvey. Although somewhat mutilated, and not in a very good state of preservation when received, it is of great interest, being, without doubt, the largest and best specimen ever preserved. The Catalina specimen, when fresh,† was 9.5 feet from tip of tail to base of arms; circumference of body, 7 feet; circumference of head, 4 feet; length of tentacular arms, 30 feet; length of

* See American Journal of Science and Arts, vol. xiv, p. 425, November, 1877. When examined by me it was loose in a tank of alcohol. Dr. J. B. Holder gave me valuable assistance in making this examination, and also made one of the drawings of the caudal fin. It was afterwards "prepared" for exhibition by a taxidermist, who misplaced the arms, siphon, and other parts, and inserted two large, round, flat, red eyes close together on the top of the head! Continued soaking in strong alcohol had reduced its dimensions to about one-half their former measurements when examined by me two years later.

† Measurements of the freshly-caught specimen were made by the Rev. M. Harvey, at Saint John's, and communicated to me.

longest sessile arms (ventral ones?), 11 feet; circumference at base, 17 inches; circumference of tentacular arms, 5 inches; at their expanded portions, 8 inches; length of upper mandible, 5.25 inches; diameter of large suckers, 1 inch; diameter of eye-openings, 8 inches. The eyes were destroyed by the captors. It agrees in general appearance with *A. Harveyi* (No. 5), but the caudal fin is broader and somewhat less acutely pointed than in that species, as seen in No. 5; it was 2 feet and 9 inches broad, when fresh, and broadly sagittate in form. The dried rims of the large suckers are white, with very acutely serrate margins; the small smooth-rimmed suckers, with their accompanying tubercles, are distantly scattered along most of the inner face of the tentacular arms, the last ones noticed being 19 feet from the tips. The sessile arms present considerable disparity in length and size, the ventral ones being somewhat larger and longer than the others, which were, however, more or less mutilated when examined by me; the serrations are smaller on the inner edge than on the outer edge of the suckers. On the smaller suckers beyond the middle of the arms the inner edge is without serrations.

No. 15.—Hammer Cove specimen, 1876.

In a letter from Rev. M. Harvey, dated August 25, 1877, he states that a big squid was cast ashore November 20, 1876, at Hammer Cove, on the southwest arm of Green Bay, in Notre Dame Bay, Newfoundland. When first discovered by his informant it had already been partially devoured by foxes and sea-birds. Of the body, a portion 5 feet long remained, with about 2 feet of the basal part of the arms. The head was 18 inches broad; tail, 18 inches broad; eye-sockets, 7 by 9 inches; stump of one of the arms, 3.5 inches in diameter.

The only portion secured was a piece of the 'pen' about 16 inches long, which was given to Mr. Harvey.

No: 16.—Lance Cove specimen, 1877. (*Architeuthis princeps?* ♀.)

In a letter dated November 27, 1877, Mr. Harvey gives an account of another specimen which was stranded on the shore at Lance Cove, Smith's Sound, Trinity Bay, about twenty miles farther up the bay than the locality of the Catalina Bay specimen (No. 14). He received his information from Mr. John Duffet, a resident of the locality, who was one of the persons who found it and measured it. His account is as follows: "On November 21, 1877, early in the morning, a 'big squid' was seen on the beach at Lance Cove, still alive and struggling desperately to escape. It had been borne in by a 'spring tide' and a high inshore wind. In its struggles to get off it ploughed up a trench or furrow about 30 feet long and of considerable depth, by the stream of water that it ejected with great force from its siphon. When the tide receded it died. Mr. Duffet measured it carefully, and found that the body was nearly 11 feet long (probably including the head), the tentacular arms

33 feet long. He did not measure the short arms, but estimated them at 13 feet, and that they were much thicker than a man's thigh at their bases. The people cut the body open and it was left on the beach. It is an out-of-the-way place, and no one knew that it was of any value. Otherwise it could easily have been brought to Saint John's with only the eyes destroyed and the body opened." It was subsequently carried off by the tide, and no portion was secured.

This was considerably larger than the Catalina specimen.

The great thickness of the short arms of this specimen, and of some of the others, indicates a species distinct from *A. Harveyi*, unless the sexes of that species differ more than is usual in this respect among the smaller squids. The length of the sessile arms, if correctly stated, would indicate that this specimen belonged to *A. princeps*. In the female *Ommastrephes illecebrosus*, the common northern squid, the head is usually larger, the short arms are stouter, and the suckers are often larger than in the male, of the same length.

No. 17.—Trinity Bay specimen, 1877.

Mr. Harvey also states that he had been informed by Mr. Duffet that another very large 'big squid' was cast ashore in October, 1877, about five miles farther up Trinity Bay than the last. It was cut up and used for manure. No portions are known to have been preserved, and no measurements were given.

No. 18.—Thimble Tickle specimen, 1878.

The capture of this specimen has been graphically described by Mr. Harvey, in a letter to the Boston Traveller of January 30, 1879:

"On the 2d day of November last, Stephen Sherring, a fisherman residing in Thimble Tickle (Notre Dame Bay), not far from the locality where the other devil-fish (No. 19) was cast ashore, was out in a boat with two other men; not far from the shore they observed some bulky object, and, supposing it might be part of a wreck, they rowed toward it, and, to their horror, found themselves close to a huge fish, having large glassy eyes, which was making desperate efforts to escape, and churning the water into foam by the motion of its immense arms and tail. It was aground and the tide was ebbing. From the funnel at the back of its head it was ejecting large volumes of water, this being its method of moving backward, the force of the stream, by the reaction of the surrounding medium, driving it in the required direction. At times the water from the siphon was black as ink.

"Finding the monster partially disabled, the fishermen plucked up courage and ventured near enough to throw the grapnel of their boat, the sharp flukes of which, having barbed points, sunk into the soft body. To the grapnel they had attached a stout rope, which they had carried ashore and tied to a tree, so as to prevent the fish from going

out with the tide. It was a happy thought, for the devil-fish found himself effectually moored to the shore. His struggles were terrific as he flung his ten arms about in dying agony. The fishermen took care to keep a respectful distance from the long tentacles, which ever and anon darted out like great tongues from the central mass. At length it became exhausted, and as the water receded it expired.

"The fishermen, alas! knowing no better, proceeded to convert it into dog's meat. It was a splendid specimen—the largest yet taken—the body measuring 20 feet from the beak to the extremity of the tail. It was thus exactly double the size of the New York specimen [No. 14], and 5 feet longer than the one taken by Budgell. The circumference of the body is not stated, but one of the arms measured 35 feet. This must have been a tentacle."

No. 19.—THREE ARMS SPECIMEN, 1878. (*Architeuthis princeps?*)

Mr. Harvey has also given an account of this specimen in the same letter to the Boston Traveller, referred to under No. 18. This one was found cast ashore, after a heavy gale of wind, December 2, 1878, by Mr. William Budgell, a fisherman, residing at a place called Three Arms, on the south arm of Notre Dame Bay. It was dead when found, and was cut up and used for dog-meat. Mr. Harvey's account is as follows:

"My informant, a very intelligent person, who was on a visit in that quarter on business, arrived at Budgell's house soon after he had brought it home in a mutilated state, and carefully measured some portions with his own hand. He found that the body measured 15 feet from the beak to the end of the tail, which is 5 feet longer than the New York specimen. The circumference of the body at its thickest part was 12 feet. He found only one of the short arms perfect, which was 16 feet in length, being 5 feet longer than a similar arm of the New York specimen, and he describes it as 'thicker than a man's thigh.'"

The statement that the sessile arms were longer than the head and body together, indicates that this was a specimen of *A. princeps*, like No. 14, but larger.

No. 20.—BANQUEREAU SPECIMEN, 1879.

This consists of the terminal part of a tentacular arm, which was taken by Capt. J. W. Collins and crew of the schooner "Marion" from the stomach of a large and voracious fish (*Alepidosaurus ferox*), together with the first specimen discovered of the remarkable squid, *Histioteuthis Collinsii* V. The fish was taken on a halibut trawl-line, north latitude 42° 49′, west longitude 62° 57′, off Nova Scotia, January, 1879. This fragment, after preservation in strong alcohol, now measures 18 inches in length. It includes all the terminal club, and a portion of the naked arm below it. This club is narrow, measuring but .75 of an inch across its front side, while the naked arm is 1.25 broad, and rather flat, where cut

off. From the commencement of the large suckers to the tip it measures 9.25 inches. It had lost most of its suckers, so that it cannot be identified with certainty. Part of the large suckers and some of the marginal ones still remain, though the horny rings are gone. Diameter of large suckers, .50 of an inch; of marginal ones, about .12 of an inch. The suckers have the same form and arrangement as in the larger specimens of *Architeuthis*. It may have belonged to a young *A. Harveyi*.

No. 21.—Cape Sable specimen. (*Sthenoteuthis megaptera* V.)

Plate XVI.

This specimen was found thrown on the shore, near Cape Sable, Nova Scotia, after the very severe gale in which the steamer "City of Boston" was lost several years ago. It is preserved in alcohol, entire and in good condition, in the Provincial Museum at Halifax, where it is well exhibited in a large glass jar. It is the type-specimen of *Architeuthis megaptera*, described by me, September, 1878.* It is a comparatively small species, its total length being but 43 inches; its head and body together, 19 inches; body alone, 14 inches; its tentacular arms, 22 and 24 inches; short arms, from 6.5 to 8.5 inches; tail-fin, 13.5 inches broad and 6 inches long.

This species differs widely from all the others in the relatively enormous size and breadth of its caudal fin, which is nearly as broad as the body is long, and more than twice as broad as long. It has been made the type of a new generic group.

No. 22.—Brigus specimen, 1879.

Mr. Harvey states that portions of another large squid were cast ashore near Brigus, Conception Bay, in October, 1879.

Two of the short arms, each measuring 8 feet in length, were found with other mutilated parts, after a storm.

No. 23.—James's Cove specimen, 1879.

From Mr. Harvey I have also very recently received an account of another specimen, which was captured entire, about the first of November 1879, at James's Cove, Bonavista Bay, Newfoundland. It seems to have been a fine and complete specimen, about the size of the Catalina Bay specimen (No. 14). Unfortunately, the fishermen, as usual, indulged immediately in their propensity to cut and destroy, and it is doubtful if any portion was preserved. The account referred to was published in the Morning Chronicle of Saint John's, Newfoundland, December 9, 1879, and was credited to the Harbor Grace Standard. The author of the article is not given. The following extract contains all that is essential: "A friend at Musgrave Town sends us the following particulars relative to the capture of a big squid at James's Cove, Goose Bay, about a month

*American Journal of Science, xvi, p. 207, 1878.

ago. Our correspondent says: 'Mr. Thomas Moores and several others saw something moving about in the water, not far from the stage. Getting into a punt they went alongside, when they were surprised to see a monstrous squid. One of the men struck at it with an oar, and it immediately struck for the shore, and went quite upon the beach. The men then succeeded in getting a rope around it, and hauled it quite ashore. It measured 38 feet altogether. The body was about 9 feet in length, and two of its tentacles or horns were 29 feet each. There were several other smaller horns, but they were not so long. The body was about 6 feet in circumference. When I saw it, it was in the water, and was very much disfigured, as one of the men had thoughtlessly cut off the two longest tentacles, and had ripped the body partly open, thereby completely spoiling the appearance of the creature. The foregoing particulars I obtained from Mr. Moores.'"

No. 24.—The Grand Banks specimen, 1880.

Plate V, figures 5–7. Plate VI.

This specimen, which I have designated as No. 24, was found, dead and mutilated, floating at the surface, at the Grand Banks of Newfoundland, April, 1880, by Capt. O. A. Whitten and crew of the schooner "Wm. H. Oakes," and by them it was well preserved and presented to the United States Commission of Fish and Fisheries. It is of great interest, because it furnishes the means of completing the description of parts that were lacking or badly preserved in the larger specimens, especially the sessile arms and the buccal membranes.

The specimen consists of a part of the head, with all the arms attached, and with the suckers in a good state of preservation on all the arms, though the tips of all the short arms, except the left of the second pair, are destroyed, and all of the arms are more or less injured on their outer surfaces. The jaws and buccal membranes, with the odontophore and œsophagus, are intact. Parts of the cartilaginous skull, with some of the ganglia and the collapsed eyes, are present, but the external surface of the head is gone and the eyelids are badly mutilated. No part of the body was preserved. The tentacular arms, with all the suckers, are in good preservation. Unfortunately, the distal portions of both the ventral arms had been destroyed, so that the sex could not be determined. The color of the head, so far as preserved, and of the external surfaces of the sessile arms, is much like that of the common squids.

Reproduction of lost parts.

This creature had been badly mutilated long before its death, as its healed wounds show, and to this fact many of the imperfections of the specimen are due. At the time of its death, or subsequently, the extremities of the ventral arms and of the third right arm appear to have been destroyed, besides other injuries. But both the dorsal arms and

both the lateral arms of the left side had previously been truncated at 12 to 13 inches from their bases. The ends had not only healed up entirely, but each one had apparently commenced to reproduce the lost portion. The reproduced part consists, in each case, of an elongated, acute, soft papilla, arising from the otherwise obtuse end of the arm. At its base one or two small suckers have already been reproduced, and minute rudiments of others can be detected on some of them. Whether these arms would have been perfectly restored in course of time is, perhaps, doubtful,* but there can be no doubt that a partial restoration would, at least, have been effected. On the basal half of several of the arms some of the suckers had also been previously lost, and these were all in the process of restoration. The restored suckers were mostly less than one-half the diameter of those adjacent, and in some cases less than one-third. Among the restored suckers were some malformations. One has a double aperture, with a double horny rim. In one case two small suckers, with pedicels in close contact, occupy the place of a single sucker. In another instance a small pediceled sucker arises from the pedicel of a larger one, near its base.

Nos. 25, 26, &c.

Architeuthis abundant in 1875 *at the Grand Banks.*

From Capt. J. W. Collins, now of the United States Fish Commission, I learn that in October, 1875, an unusual number of giant squids were found floating at the surface on the Grand Banks, but mostly entirely dead and more or less mutilated by birds and fishes. In very few cases they were not quite dead, but entirely disabled. These were seen chiefly between north latitude 44° and 44° 30′, and between west longitude 49° 30′ and 49° 50′. He believes that between 25 and 30 specimens were secured by the fleet from Gloucester, Mass., and that as many more were probably obtained by the vessels from other places. They were cut up and used as bait for codfish. For this use they are of considerable value to the fishermen. Captain Collins was at that time in command of the schooner "Howard," which secured five of these giant squids. These were mostly from 10 to 15 feet long, not including the arms, and averaged about 18 inches in diameter. The arms were almost always mutilated. The portion that was left was usually 3 to 4 feet long, and at the base about as large as a man's thigh.

One specimen (No. 25), when cut up, was packed into a large hogshead-tub having a capacity of about 75 gallons, which it filled. This tub was known to hold 700 pounds of codfish. The gravity of the *Architthis* is probably about the same as that of the fish. This would indicate more nearly the actual weight of one of these creatures than any of the

*That mutilations of the arms in species of *Octopus* are regularly restored is well known, but it has been stated by Steenstrup that this does not occur in the ten-armed forms. I have repeatedly observed such restorations in *Loligo* and *Ommastrephes*.

mere estimates that have been made, which are usually much too great. Allowing for the parts of the arms that had been destroyed, this specimen would, probably, have weighed nearly 1,000 pounds.

Among the numerous other vessels that were fortunate in securing this kind of bait, Captain Collins mentions the following:

The schooner "Sarah P. Ayer," Captain Oakly, took one or two.

The "E. R. Nickerson," Captain McDonald, secured one that had its arms and was not entirely dead, so that it was harpooned. Its tentacular arms were 36 feet long (No. 26).

The schooner "Tragabigzanda," Captain Mallory, secured three in one afternoon. These were 8 to 12 feet long, not including the arms.

These statements are confirmed by other fishermen, some of whom state that the "big squids" were also common during the same season at the "Flemish Cap," a bank situated some distance northeast from the Grand Banks.

The cause of so great a mortality among these great Cephalopods can only be conjectured. It may have been due to some disease epidemic among them, or to an unusual prevalence of deadly parasites or other enemies. It is worth while, however, to recall the fact that these were observed at about the same time, in autumn, when most of the specimens have been found cast ashore at Newfoundland in different years. This time may, perhaps, be just subsequent to their season for reproduction, when they would be so much weakened as to be more easily overpowered by parasites, disease, or other unfavorable conditions.

Histioteuthis Collinsii Verrill.

In addition to the foregoing examples, all of which, except No. 21, are believed to be referable to the genus *Architeuthis*, I have, in former articles* described a very remarkable large squid, belonging to the genus *Histioteuthis*, in which a broad thin membrane or web unites the six upper arms together nearly to their tips, while the lower ones have a shorter web uniting them to the rest. Although small, when contrasted with the gigantic specimens of *Architeuthis*, it is considerably larger than any of the common small squids, and as it inhabits the same localities with *Architeuthis*, and has some points of resemblance to the latter genus, especially in having the smooth-rimmed suckers for uniting together the long tentacular arms, I have thought it best to mention it in this part of my article, in connection with the species of *Architeuthis*. The only specimen known was obtained (with No. 20) from the stomach of a large and voracious fish (*Alepidosaurus ferox*), having a formidable array of long, sharp teeth, eminently adapted for the capture of such prey. It was taken by Capt. J. W. Collins and crew, of the schooner "Marion," in deep water off the coast of Nova Scotia, and presented to the United States Fish Commission. This species (*H. Collinsii*) is figured on Plate XXIII, and will be described farther on.

*American Journal of Science, vol. xvii, p. 241, 1879; vol. xix, p. 29, pl. 14, 1880; Trans. Conn. Acad., vol. v, pp. 195, 234, pl. 22.

Moroteuthis robusta (Dall, sp.) Verrill.

In this connection I may also refer to a gigantic Pacific Ocean species, obtained by Mr. W. H. Dall, on the coast of Alaska, in 1872, which will be described as fully as possible in another part of this article, when discussing the foreign species of large Cephalopods (see Plates XIII and XIV). Three specimens were observed and measured by Mr. Dall. The largest one measured, from the base of the arms to the end of the body, 8.5 feet. The ends of all the arms had been destroyed in all the specimens. It was originally† briefly described by me under Mr. Dall's MSS. name, *Ommastrephes robustus*, but a more careful study of the parts preserved, especially the 'cone' of the 'pen' and the odontophore, convinced me that it belongs to the family *Teuthidæ*, characterized especially by having rows of sharp claws or hooks on the 'club' of the tentacular arms, instead of suckers.‡ It was of special interest, to add another generic type to the list of gigantic species.

†American Journal of Science, vol. xii, p. 236, 1876.

‡Trans. Conn. Acad., vol. v., p. 246.

Comparative measurements of the specimens (in inches).

	Architeuthis Harveyi?										Architeuthis princeps?									
	No. 2.	No. 3.	No. 4.	No. 5, fresh.	No. 5, in alcohol.	No. 8.	No. 9.	No. 11.	No. 15.	No. 24.	No. 1.	No. 7.	No. 10.	No. 13.	No. 14.	No. 16.	No. 18.	No. 19.	No. 22.	No. 23.
Total length, to tip of tentacular arms	.....	624	384	382	.....	480	540	.....	.....	.....	.....	624	.....	450?	480	528	660	.....	.....	456
Total length, to tip of short arms	.....	.....	.....	166	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	246	.....	.....	.....	.....	.....
Base of arms to insertion of tail-fin	.....	.....	.....	75	.....	.....	.....	.....	.....	.....	.....	.....	.....	120	95	.....	.....	.....	.....	.....
Base of arms to tip of tail	.....	120	.....	92	.....	.....	.....	168?	.....	.....	170?	180	.....	140?	114	132	240	180	.....	108
Head, length (base of arms to mantle)	.....	.....	.....	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	14?	.....	.....	.....	.....	.....
Mantle edge to tip of tail, above	.....	.....	.....	82	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	100?	.....	.....	.....	.....	.....
Circumference of body	.....	90?	72	66	.....	.....	.....	.....	.....	.....	56?	.....	.....	.....	84	.....	.....	144	.....	72
Circumference of head	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	36	48	.....	.....	.....	.....	.....
Breadth of head, across eyes	.....	.....	.....	.....	.....	.....	.....	.....	18	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Breadth of eye-openings	.....	.....	.....	.....	.....	.....	.....	.....	7 × 9	3	.....	.....	.....	.....	8	.....	.....	.....	.....	.....
Length of tail-fin (tip to insertion)	.....	.....	.....	18?	17	.....	.....	.....	.....	.....	.....	.....	.....	20?	19 p.	.....	.....	.....	.....	.....
Breadth of tail-fin	.....	.....	.....	22	16	.....	.....	.....	18	.....	.....	.....	.....	.....	28 p.	.....	.....	.....	.....	.....
From outer angle to tip of tail-fin	.....	.....	.....	27?	23	.....	.....	.....	.....	.....	.....	.....	.....	.....	24.5 p.	.....	.....	.....	.....	.....
Outer angle of tail-fin to side of body	.....	.....	.....	.....	6.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	10 p.	.....	.....	.....	.....	.....
Length of tentacular arms	348?	504	.....	288	161	.....	.....	384	.....	67	.....	444	.....	312	360	396	420	.....	.....	348
Length of 'club' bearing rows of suckers	30	.....	.....	30	30	.....	.....	.....	.....	8.25	.....	.....	.....	.....	30.5 p.	.....	.....	.....	.....	.....
Part bearing largest suckers	18	.....	.....	15	14	.....	.....	.....	.....	4.25	.....	.....	.....	.....	19 p.	.....	.....	.....	.....	.....
Length of longest sessile arms	.....	72	.....	72	.....	.....	.....	120	.....	26.25	120+	.....	.....	104?	132	156?	.....	192	96	.....
Circumference of largest sessile arms (at base)	.....	9	.....	10	8	.....	.....	.....	10.5	.....	22	.....	.....	16?	17	.....	.....	.....	.....	.....
Breadth of largest sessile arms (at base)	.....	.....	.....	.....	3	.....	.....	.....	3.5?	1.10	.....	.....	.....	.....	6	.....	.....	.....	.....	.....
Circumference of tentacular arms (middle)	4	.....	.....	2½–3	2.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	.....	.....	.....	.....	.....
Circumference of 'club' of same	6	.....	.....	.....	4.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	6 p.	.....	.....	.....	.....	.....
Diameter of largest suckers of club	1.28	.....	.92	1.25	1.15	.....	.....	2.25?	.....	.35	.....	2	.....	1.10	1.15	.....	.....	.....	.....	.....
Diameter of largest suckers of short arms	.....	.....	.....	1	.....	.....	.....	.....	.....	.31	.....	.....	.....	.....	1	.....	.....	.....	.....	.....
Upper jaw, total length	.....	.....	3.55	.....	3.85	.....	.....	.....	.....	.....	.....	.....	5	4 +	5.25	.....	.....	.....	.....	.....
Upper jaw, breadth (front to back)	.....	.....	2.5+	.....	2.50	.....	.....	.....	.....	.....	.....	.....	3.50	3.24	3.88	.....	.....	.....	.....	.....
Lower jaw, total length	.....	.....	.....	.....	3	.....	.....	.....	.....	.....	.....	.....	3.63	3.24	3.75	.....	.....	.....	.....	.....
Lower jaw, total breadth	.....	.....	.....	.....	2.65	.....	.....	.....	.....	1.20	.....	.....	.....	3.08	3.88	.....	.....	.....	.....	.....
Lower jaw, tip of beak to notch	.....	.....	.62	.....	.65	.....	.....	.....	.....	.32	.65	.....	.80	.71	.87	.....	.....	.....	.....	.....

The measurements given from the preserved specimen of No. 14 are designated by p. affixed.

SPECIAL DESCRIPTIONS OF THE ATLANTIC COAST SPECIES.

Architeuthis Steenstrup.

Architeuthus Steenstrup, Oplysninger om Atlanter, Collossale Blæksprutter, Förhandlinger Skand. Naturf., 1856, vol. vii, p. 182, Christiana, 1857 (name proposed, but no generic characters given).

Architeuthis Harting, Verh. K. Akad., Weten., Natuurk., IX, 1860.

Megaloteuthis Kent, Proc. Zool. Soc., London, 1874, p. 178 (no generic characters given).

Size large. Body stout, nearly round, swollen in the middle. Caudal fin, in the typical species, relatively small, sagittate. Head large, short. Eyes very large, oblong-ovate, with well-developed lids and anterior sinus. Sessile arms stout, their suckers large, very oblique, with the edges of the horny rings strongly serrate, especially on the outer margin. The suckers of the basal half of all the arms, except the ventral ones, differ from the distal ones in being denticulated all around and less oblique. The margin has around it a free-edged membrane, which closely surrounds the denticles when the sucker is used, and allows a vacuum to be produced. Tentacular arms very long and slender, in extension, the proximal part of the club furnished with an irregular group of small, smooth-rimmed suckers, intermingled with rounded tubercles on each arm, the suckers on one arm corresponding with the tubercles of the other, so that by them the two arms may be firmly attached together without injury, and thus used in concert; other similar suckers and tubercles, doubtless for the same use, are distantly scattered along the slender part of these arms, one sucker and one tubercle occurring near together. A small cluster of smooth-edged suckers also occurs at the tips. The internal shell (imperfectly known in one species only) has a thin and very broad, lanceolate posterior blade, expanding forward from the end, with divergent ribs.

This genus is closely allied to *Ommastrephes*, from which it may be best distinguished by the presence of the peculiar connective suckers and tubercles for uniting the tentacular arms together.

Architeuthis Harveyi Verrill.—(Harvey's Giant Squid.)

Megaloteuthis Harveyi Kent, Proc. Zool. Soc. London, 1874, p. 178.

Architeuthis monachus Verrill, Amer. Journal Science, vol. ix, pp. 124, 177, pl. 2, 3, 4, 1875; vol. xii, p. 236, 1876. American Naturalist, vol. ix, pp. 22, 78, figs. 1–6, 10, 1875 (*? non* Steenstrup).

Ommastrephes Harveyi Kent, Proc. Zool. Soc. London, 1874, p. 492.

Ommastrephes (*Architeuthis*) *monachus* Tryon, Manual of Conchology, vol. i, p. 184, pl. 83, fig. 379, pl. 84, figs. 380–385, 1879. (Descriptions compiled and figures copied from the papers by A. E. V.)

Architeuthis Harveyi Verrill, Trans. Conn. Acad., vol. v, pp. 197, 259, pls. 13–16 a, 26, 1879–'80. Amer. Journal Science, vol. xix, pp. 284, 287, pl. 13, 1880.

Plates I—VI.

The diagnostic characters of this species, so far as determined, are as follows: Sessile arms unequal in size, nearly equal in length, decidedly shorter than the head and body together, and scarcely as long as the body alone, all bearing sharply serrated suckers; their tips slender and acute. Tentacular arms, in extension, about four times as long as the short ones; about three times as long as the head and body together. Caudal fin small, less than one-third the length of the mantle, sagittate in form, with the narrow lateral lobes extending forward beyond their insertions; the posterior end tapering to a long, acute tip. Jaws with a smaller notch and lobe than in *A. princeps*. Larger suckers, toward the base of the lateral and dorsal arms, with numerous acute teeth all around the circumference, all similar in shape, but those on the inner margin smaller than those on the outer. Remainder of the suckers on these arms, and all of those on the ventral arms, toothed on the outer margin only. Sexual characters are not yet determined.

Special description of the specimen No. 5.—The preserved parts of this specimen (see p. 8) examined by me are as follows: The anterior part of the head, with the bases of the arms, the beak, lingual ribbon, &c.; the eight shorter arms, but without the suckers, which dropped off in the brine, and are now represented only by a few of the detached marginal rings; the two long tentacular arms, which are well preserved, with all the suckers in place; the caudal fin; portions of the pen or internal shell; the ink-bag; and pieces of the body.

The general appearance and form of this species* are well shown by

*Mr. W. Saville Kent, from the popular descriptions of this species, gave it new generic and specific names, viz, *Megaloteuthis Harreyi*, in a communication made to the Zoological Society of London, March 3, 1874 (Proceedings Zool. Soc., p. 178; see also Nature, vol. ix, p. 375, March 12, and p. 403, March 19). My former identification was based on a comparison of the jaws with the jaws of *A. monachus*, well figured and described by Steenstrup in proof-sheets of a paper which is still unpublished, though in part printed several years ago, and referred to by Harting. The agreement of the jaws is very close in nearly all respects, but the beak of the lower jaw is a little more divergent in Steenstrup's figure. His specimen was a little larger than the one here described, and was taken from a specimen cast ashore at Jutland in 1853. Mr. Kent was probably unacquainted with Steenstrup's notice of that specimen when he said (Nature, vol. ix, p. 403) that *A. monachus* "was instituted for the reception of two gigantic Cephalopods cast on the shores of Jutland in the years 1639 and 1790, and of which popular record alone remains." In his second communication to the Zoological Society of London, March 18, 1874 (Proc., p. 490), he states (on the authority of Crosse and Fischer) that a third specimen "was stranded on the coast of Jutland in 1854, and upon the pharynx and beak of this, the only parts preserved, the same authority founded his species *Architeuthis dux*." The specimen here referred to is evidently the same that Steenstrup named *A. monachus*, in 1856. The confusion in reference to these names is evidently due to this mistake.

The statement that *Architeuthis dux* Steenstrup is known from the beak alone is evidently erroneous. Steenstrup himself, Harting, and Dr. Packard, in their articles on this subject, all state that the suckers, parts of the arms, and the internal shell or pen were preserved, and they have been figured, but not published, by Professor Steen-

Plates I and II. The body was relatively stout. According to the statement of Mr. Harvey, it was, when fresh, about 213cm (7 feet) long and 5½ feet in circumference. The 'tail' or caudal fin (Plate I, fig. 2, and Plate IV, fig. 11) is decidedly sagittate, and remarkably small in proportion to the body. It is said by Mr. Harvey to have been 55.9cm (22 inches) across, but the preserved specimen is considerably smaller, owing, undoubtedly, to shrinkage in the brine and alcohol. The posterior termination is unusually acute, and the lateral lobes extend forward considerably beyond their insertion. In the preserved specimen the total length, from the anterior end of the lateral lobes to the tip of the tail, is 58.4cm (23 inches); from the lateral insertions to the tip, 48.2cm (19 inches); total breadth, about 38cm (15 inches); width of lateral lobes, 15.2cm (6 inches). The eight shorter arms, when fresh, were, according to Mr. Harvey's measurements, 182.9cm (6 feet) long, and all of equal length,* but those of the different pairs were, respectively, 25.4cm, 22.9cm, 20.3cm, and 17.8cm (10, 9, 8, and 7 inches) in circumference.†

strup. Harting has also given a figure of the lower jaw, copied from a figure by Steenstrup. In the proof-sheets that I have seen this specimen is referred to as "*A. titan*," but Harting cites it as *A. dux* Steenstrup, which is the name given to it by Steenstrup in his first notice of it, in 1856. Therefore, two distinct species were confounded under this name by Kent. His rejection of the generic name, *Architeuthis*, might, perhaps, have been justified on the ground that Steenstrup had never published any definite description of it, and that he had mentioned no distinctive generic characters in his brief notice, had not Harting's article given, indirectly, sufficient information to justify us in adopting the genus. But Kent's genus rests on no better foundation than *Architeuthis*, for he gave to it no characters that can be considered generic. *Actual generic characters of Architeuthis* were first given in my articles in 1875, but those then given for the *pen* and *dentition* were erroneous. Previous to that time no characters had been published, either by Steenstrup, Harting, or Kent, sufficient to distinguish the genus from *Ommastrephes* and *Loligo*, much less from *Sthenoteuthis*, to which it is most closely allied.

I have more recently been led to consider our species distinct from the true *A. monachus* by correspondence with Professor Steenstrup, from whom I learn that the caudal fin in his species does not agree with that of the species here described, and that in his species the ventral arms differ from the others, both in form and in the character of the suckers. Certain differences in the arms can be detected in the photograph of our specimen (reproduced on Plate I), in which, fortunately, the ventral arms are well displayed. Unless these differences prove to be sexual characters, which is not likely, they would indicate a specific difference. Therefore, I have, for the present, adopted the specific name given by Kent to the Newfoundland specimens. The name was given as a well-merited compliment to the Rev. M. Harvey, who has done so much to bring these remarkable specimens into notice. Nevertheless, it is probable that when the original specimens of *A. monachus* shall have been fully described and figured, so as to make the species recognizable, one of our species may prove to be identical with it. At present I am unable to decide whether the affinities of *A. monachus* may not be with *A. princeps* rather than with *A. Harveyi*. Recently I have had an opportunity to study the suckers of a young specimen of our species (No. 24) in place. In this the suckers on the basal part of the ventral arms differ from the corresponding ones of the other arms in being denticulate only on the outer side.

*It is possible that they may have been originally somewhat unequal, and that mutilation of their tips made them appear more nearly equal than they were in life.

†In the original statement it is not mentioned to which pairs of arms these dimensions apply. After having been five years in alcohol, the ventral arms now measure

They are, except the ventral, compressed trapezoidal in form, and taper very gradually to slender, acute tips; their inner faces, along the proximal half of their length, are occupied by two alternating rows of large, obliquely campanulate suckers, with contracted apertures, surrounded by broad, oblique, thin, horny, marginal rings, much broader on the outer side than on the inner, and armed with strong, acute teeth around their entire circumference, but the teeth are largest and most oblique on the outside (Plate IV, figs. 5–8). The suckers gradually diminish in size to the tips of the arms, where they become very small; those toward the tips of the arms appear to have been denticulate on the outer side, and entire, or nearly so, on the inner margin. The ventral arms still have, as they show in the photograph, the inner face much broader than it is in the others, especially near the base, and they are more nearly square than any of the others. Their suckers are more numerous, farther apart transversely, and closer together in the longitudinal series, there being about 46 on the proximal half (36 inches) of each, while on each of the subventral arms there are only about 30 on the corresponding portion; the suckers also diminish rather abruptly in size at about 26 to 30 inches from the base, beyond which they are scarcely more than half as large as those on the second and third pairs of arms, at the same distance from the base; it is probable, judging from the small specimen (No. 24), that all the suckers of the ventral arms were denticulate only on the outer margin. The largest of these suckers are said by Mr. Harvey to have been about an inch in diameter when fresh. The largest of their marginal rings in my possession are 16^{mm} to 17^{mm} in diameter at the serrated edge, and 18^{mm} to 21^{mm} beneath.

The horny rings are yellowish horn-color, oblique, and more than twice as high on the back side as in front. A wide peripheral groove runs entirely around the circumference, just below the denticulated margin; it is narrower and deeper on the inner side. On the inner side of the largest kind (*c*, *d*, *e*, *g*) the edge is nearly vertical, and the denticles point upward or are but slightly incurved; but on the outer side the edge and denticles are bent obliquely inward; along the lateral sides the edge is more or less incurved, and the denticles are inclined more or less forward, toward the inner edge of the sucker (figs. 5, 6, 6*a*). The denticles are golden yellow, or when dry silvery white; those on the outer and lateral margins are largest, flat, lanceolate, with sharply beveled lateral edges and acuminate tips; those on the front margin are shorter, narrower, acutely triangular, and in contact at their bases. On the largest of these suckers there are forty-eight to fifty denticles. Some of the suckers (figs. 7, 7*a*, 8) of rather smaller size (*a*, *b*) are more oblique, with the outer side of the

7.5 inches in circumference, and one of the lateral ones (perhaps one of the third pair) 8 inches. The marginal membranes and crests had decayed, apparently, before the arms were preserved. The terminal portions of the arms are also gone, so that their real length cannot be given.

horny rings relatively wider and more incurved; the denticles of the outer margin are strongly incurved and decidedly narrower and more acute than the lateral ones, which are broad-triangular; the inner or front denticles are rather smaller, acute-triangular, and usually inclined somewhat inward. On these there are forty to forty-six denticles. The rings of the smaller suckers are still more oblique and more contracted at the aperture than those of the larger ones, with the teeth more inclined inward, those on the outer margin being largest.

Among the loose sucker-rims there are some which differ from the others in having the rim more oblique, and the inner edge with nearly obsolete teeth. These suckers of the second kind differ from the corresponding ones of *A. princeps* in having, on the outer margin, more numerous, more slender, and sharper teeth, which taper regularly from base to tip and are not so flattened. The larger of these sucker-rims (*i*) are 14.5^{mm} in diameter across the base; aperture, 9^{mm}; height at back, 7^{mm}; in front, 2^{mm}; number of large denticles on outer margin, ten to fourteen; the inner margin, except in the smaller ones, is either finely toothed or distinctly crenulated, and there are usually one or more irregular, broad, sharp lobes or imperfect teeth on the lateral margins. The teeth of the outer margin are regular, strongly incurved, tapering from the base to the very sharp tips, and sharply beveled on the edges. A smaller one (*j*), 11^{mm} across the base and 4.5^{mm} across the aperture, with height of back 6^{mm}, has five regular sharp teeth on the outer margin, two broad irregular ones on each side, while the front edge is nearly entire. These are supposed to come from the ventral arms. Others (*h*) are completely intermediate between the two principal forms, having very oblique rims, with a small aperture, but distinctly denticulate all around, the denticles on the inner margin being distinctly smaller than on the outer.

Measurements of sucker-rims from short arms (in millimeters).

	a. (alc.)	*b.* (alc.)	*c.* (alc.)	*d.* (dry.)	*e.*	*f.*	*g.*	*h.*	*i.*	*j.*
Diameter, outside, at base	17	17	20	18	21	19	20.5	16	14.5	11
Diameter of aperture	13	10	16	14	17	16	16.5	9.5	9	4.5
Height of horny ring, back side	7.5	9	8	7	8	7.5	7.5	9.5	7	6
Height of horny ring, front side	3	3	3.5	3	3	3	3	3	2	1.5
Number of distinct denticles	46	41	50	49	50	48	49	34	14	7

The two long tentacular arms are remarkable for their slenderness and great length when compared with the length of the body. Mr. Harvey states that they were each 731.5^{cm} (24 feet) long and 7^{cm} (2.75 inches) in circumference when fresh. In the brine and alcohol they have shrunk greatly, and now measure only 411.5^{cm} (13.5 feet) in length, while the circumference of the slender portion varies from 5.7^{cm} to 7.25^{cm} (2.25 to 3.25 inches). These arms were evidently highly contractile, like those of many small species, and consequently the length and diameter would

vary greatly according to the state of contraction or relaxation. The length given (24 feet) probably represents the extreme length in an extended or flaccid condition, such as usually occurs in these animals soon after death. The slender portion is nearly three-cornered or triquetral in form, with the outer angle rounded, the sides slightly concave, the lateral angles prominent, and the inner face a little convex and generally smooth (Plate I, fig. 1, *e e*.)

The terminal portion, bearing the suckers, is 76.2^{cm} in length and expands gradually to the middle, where it is 11.4^{cm} to 12.7^{cm} in circumference (15.3^{cm} when fresh) and 3.9^{cm} to 4.1^{cm} across the face. The sucker-bearing portion may be divided into three parts. The first region (*i* to *i i*) occupies about 17.8^{cm} (7 inches); here the arm is rounded-triquetral, with margined lateral angles, and gradually increases up to the maximum size, the inner face being convex and bearing about forty irregularly scattered, small, flattened, saucer-shaped suckers, attached by very short pedicels, and so placed in depressions as to rise but little above the general surface. The larger ones are 5^{mm} to 6^{mm} in external diameter; 3^{mm} across aperture; 1.5^{mm} high. The smaller ones have a diameter of 4^{mm}; aperture, 2.5^{mm}; height, 1^{mm}. The horny ring (Plate IV, Figs. 9, 9*a*) is circular, thin, and of about uniform breadth all around; the edge is smooth and even, slightly everted; just below the edge there is a groove all around; below this a prominent, rounded ridge surrounds the periphery, below which the lower edge is somewhat contracted. A thick, soft membrane surrounds the edge. These suckers are at first distantly scattered, but become more crowded distally, forming six to eight irregular alternating rows, covering the whole width of the inner face, which becomes 4.1^{cm} broad. Scattered among these suckers are about an equal number of low, broad, conical, smooth, callous verrucæ, or wart-like prominences, rising above the general surface, their central elevation corresponding in form and size to the apertures of the adjacent suckers. These, without doubt, are intended to furnish secure points of adhesion for the corresponding suckers of the opposite arm, so that, as in some other genera, these two arms can be fastened together at this wrist-like portion, and thus may be used unitedly. By this means they must become far more efficient organs for capturing their prey than if used separately. The absence of denticulations prevents the laceration of the creature's own flesh, which the sharp teeth of the other suckers would produce under pressure, and the verrucæ prevent the lateral slipping, to which unarmed suckers applied to a smooth surface would be liable. Between these smooth suckers and the rows of large ones there is a cluster of about a dozen small suckers, with sharply serrate margins, from 5^{mm} to 8^{mm} in diameter, attached by slender pedicels. They are arranged somewhat irregularly in four rows, those of the outer rows more oblique, and corresponding in form with the larger marginal suckers.

The second division (ii to iii), 35.6^{cm} in length, succeeds the small suck-

ers. Here the arm is flattened on the face, rounded on the back, and provided with a sharp dorsal carina, increasing in width toward the tip. It bears two alternating rows of about twelve very large, serrated suckers, and an outer row of smaller ones, on each side, alternating with the large ones. The upper edge is bordered by a rather broad, regularly scalloped, marginal membrane, the scallops corresponding to the large suckers, while prominent transverse ridges, midway between the large suckers, join the membrane and form its lobes. On the lower edge there is a narrower and thinner membrane, which runs all the way to the tip of the arm. In one (the lower) of the rows of large suckers there are eleven, and in the other ten, above 20^{mm} in diameter. The former row has one additional sucker at its proximal end, 15^{mm} in diameter, and three others at its distal end, respectively 16^{mm}, 12^{mm}, and 8^{mm} in diameter. The other row, of ten suckers, is continued by a proximal sucker 10^{mm} in diameter, and by two distal ones, respectively 15^{mm} and 13^{mm} in diameter. The number of large suckers in each row may, therefore, be counted as 12, 13, or 14, according to the fancy of the describer, there being no well-defined distinction between the larger and smaller ones in either row. The largest suckers, along the middle of the rows, are from 24^{mm} to 30^{mm} in diameter (Plate IV, fig. 4, *a*). They are attached by slender but strong pedicels, about 10^{mm} long and 6^{mm} to 7^{mm} in diameter. The outer or back side of these suckers is 16^{mm} to 18^{mm} high; the inner side 10^{mm} to 11^{mm}, so that the rim is about 24^{mm} to 28^{mm} above the surface of the arm. The horny rings are 7^{mm} to 8^{mm} high and have the aperture 20^{mm} to 23^{mm} in diameter. Each one is situated in the center of a pentagonal depressed area, about 25^{mm} across, bounded by ridges, which alternate regularly and interlock on the two sides, so as to form a zigzag line along the middle of the arm. These large suckers are broadly and obliquely campanulate, but much less oblique than those of the short arms; the marginal ring is strong, and sharply serrate all around; the denticles are acute-triangular and nearly equal. The rings are somewhat calcified and rather rigid when dried; a well-marked broad groove runs around the entire circumference, below the bases of the denticles.

The small marginal suckers (fig. 4, *b*) are similar in structure, but much more oblique, and mostly 9^{mm} to 11^{mm} in diameter; they are attached by much longer and more slender pedicels, and their marginal teeth are relatively longer, sharper, and more incurved, especially on the outer margin. The peripheral groove is broad and deep, but is interrupted on the outer side for about a third of the circumference; the outer third portion of the horny ring is somewhat flattened from the circular form.

The terminal division (iii to iv) of the arm is 22.8^{cm} long. It gradually becomes compressed laterally, and tapers regularly to the tip, which is flat, blunt, and slightly incurved. Just beyond the large suckers, where this region begins, the circumference is 9^{cm}. The face is narrow and bears a large number of small pediceled suckers (Plate IV, figs. 10, 10 *a*), arranged in four regular, alternating rows, gradually diminishing in size

to near the tip of the arm, where the rows expand into a small cluster of about ten smooth-edged suckers. The suckers, except in the final group, are much like the marginal ones of the previous division, and at first are 5mm to 7mm in diameter, but decrease to about 2.5mm near the tip of the arm. They have sharply serrate, oblique, marginal rings, higher on the outer side, with a peripheral groove on the inner and lateral sides only. In our preserved specimens the rings are gone from many of these small suckers, but those of the two rows next to the lower margin appear to have been larger than the others.

The suckers of the final group are close to the tip, which is slightly recurved over them. They are flat, attached to short pedicels, and provided with a narrow horny rim, which has the edge smooth, or nearly so, and surrounded by a thick membranous border. The diameter of these suckers is from .5mm to 2mm. They are rather crowded, and the cluster is broader than long.

The color of the body and arms, where preserved, is pale reddish, with thickly scattered, small spots of brownish red.

The form of the jaws* of this specimen is well shown by Plate III, figs. 1, 2. When in place the tips of these jaws constitute a powerful beak, looking something like that of a parrot or hawk, except that the upper jaw shuts into the lower, instead of the reverse, as in birds. The color is dark brown, becoming almost black toward the tip, where its substance is thicker and firmer, and smoothly polished externally. The upper jaw (Plate III, fig. 1), in 1875, measured 79mm in total length, 25mm in transverse breadth, and 66mm in breadth or height. The lower jaw (fig. 2) was 76mm long, 70mm transversely, and 67mm broad, vertically. It was larger when first received, but has subsequently shrunk considerably more, in alcohol.

The upper mandible has the rostrum strong, convex, acute, and curved considerably forward, with concave cutting edges, and a slight notch at its base. The anterior edges of the alæ are irregular and uneven. The palatine lamina is broad and thin.

The lower mandible has the rostrum stouter and less curved, the tip acute, with a distinct notch just below the tip, the cutting edges nearly straight, and with a moderately deep and rather narrow notch at its base; a ridge runs backward from near the tip, in a curved line, cir-

*In order to explain the terms employed in describing the various parts of the jaws of Cephalopods, as used in this article, I have introduced figures of the jaws of one of our common small squids (*Loligo pallida* V.) from Long Island Sound. The nomenclature adopted is essentially that used by Professor Steenstrup.

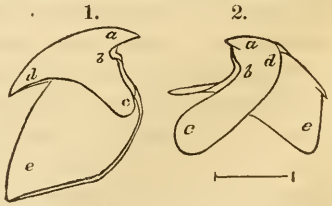

Fig. 1. Upper mandible: *a*, rostrum or tip of the beak; *b*, the notch; *c*, the inner end of ala; *d*, the frontal lamina; *e*, the palatine lamina; *ab*, the cutting edge of beak; *bc*, anterior or cutting edge of ala.

Fig. 2. Lower mandible: *a*, rostrum; *ab*, cutting edge; *bc*, anterior edge of ala; *d*, mentum or chin; *e*, gular lamina.

cumscribing a more flattened area, on which are grooves and ridges parallel with the notch. Beyond the notch, on the anterior edges of the alæ, there is, on each side, a broad, low, obtuse lobe or tooth, beyond which the edge is even and slightly concave to near the end of the alæ. The lamina of the mentum is short and strongly emarginate in the median line. Detailed measurements of the parts are given in the table of measurements on a subsequent page.

The roof of the mouth, or palate, between the anterior portions of the palatine laminæ, is lined with a rather firm, somewhat chitinous or parchment-like membrane, having its surface covered with strong, acute, recurved, yellowish teeth, apparently chitinous in nature, attached by broad, oval, or roundish flattened bases (Plate V, figs. 4, 5). These teeth are mostly curved, and very unequal in size and form, the various sizes being intermingled. They are arranged in irregular quincunx, in many indefinite rows. Many irregular, roundish, rough, white, stony granules are also attached to this membrane, among the teeth. Similar granules (Plate V, fig. 4*a*) occur in large numbers on the thinner extension of this membrane, which everywhere lines the mouth and pharynx.

The radula is about 64^{mm} in total length, with the dentigerous portion, where widest, about 11^{mm} in width. The teeth are in seven rows, with an exterior row of small, unarmed, thin, rhomboidal plates on each side, thus conforming to the arrangement in the other ten-armed Cephalopods. The teeth are deep amber-color to dark brown, and not unlike those of *Loligo* and *Ommastrephes* in form. Those of the median row have three fangs, the central one longest; those in the next row, on either side, have two fangs, while those of the two outer lateral rows, on each side, are acute and strongly curved; the outermost longest and simple, the next to the outer often having a small denticle on the outer side, near the base. (See Plate V, figs. 1, 2, 3.)

The membrane of the odontophore is broad, firm, and thick; the dentigerous portion occupies only about a third of its width, in the middle or broader portion, where it is bent abruptly back upon itself. The lower or ventral portion measures, from the anterior bend to the end, 20^{mm}; it narrows gradually to the broad, obtuse end, the width of the dentigerous portion decreasing from 9^{mm} to 5^{mm}, the naked lateral membrane decreasing from 8^{mm} to a very narrow border. The upper portion, from the bend to the end, measures 42^{mm} in length (in a straight line). The upper surface is deeply concave and infolded, at first, with the lateral membrane broad and recurved; farther back it becomes more flattened, with the dentigerous portion broader (11^{mm}), while the lateral membrane is abruptly narrowed and then extends to the end as a very narrow border. Toward the end the rows of teeth become more separated and the teeth smaller and paler, while the membrane becomes thinner and narrower.

The internal shell, or pen, was represented by numerous detached pieces, which, after much trouble, I succeeded in locating and match-

ing, so as to restore the posterior end and some of the middle portions, giving some idea as to what its original structure must have been. The texture and structure of this part of the pen was somewhat like that of *Loligo*, but it was thinner, and had less definite outlines, and less of the peculiar quill-shape seen in the latter. The anterior end of the blade, instead of being even and regular in outline, appears to have been broadly rounded, or somewhat abrupt, with an indefinite outline, thinning out gradually on all sides into a soft, fibrous membrane, while the shaft, or or quill-portion, was not so distinctly differentiated from the broad, thin blade, which tapered to the posterior end, and was probably slightly hooded at the tip. The fragments in my possession belong to four more or less separated sections. The first section includes 11 inches of the posterior end, from close to the extreme tip forward; the second section includes about 9 inches, belonging to the posterior portion, and extends to about 25 inches from the posterior end, but lacks the extreme lateral margins outside the costæ (Plate III, fig. 3); the third section consists of about 7.5 inches, belonging to the middle region, but does not include the whole width on either side of the midrib; the fourth section is about 10 inches in length, and probably came from near the anterior end of the blade, apparently representing nearly the whole width on both sides.

From these fragments we can restore pretty accurately the last 25 inches and 12 inches or more of the middle portion, though the precise form of the indefinite anterior end of the blade must remain doubtful. The extreme posterior tip is broken off, but it was evidently pointed and thin as in *Ommastrephes*. At the mutilated end the breadth is now about a third of an inch. From this point the lateral edges diverge rapidly, with a slightly concave outline, for about 1.25 inches, where the breadth becomes 1.20 inches; beyond this the margins are nearly straight, and diverge gradually to the end of the first section, at 11 inches from the tip. At this place the breadth is 3.10 inches, the marginal portions outside of the lateral costæ being about .40 of an inch and the midrib about .25 of an inch broad. Beyond this point a section about 4.75 inches long is entirely wanting, and the succeeding section lacks the marginal portions, the lateral costæ forming the margins on both sides. At 19.50 inches from the tip the breadth between the lateral costæ is 3.75 inches; at 25 inches it is 5 inches broad. Whether the marginal portions originally extended to this point with a breadth as great as they have at 11 inches is uncertain, for their breadth decreases somewhat to that point, from a point about 4 inches from the tip, where their breadth is .60 of an inch. The midrib is strongly marked, being raised into a semi-cylindrical form, and of somewhat thicker material than the lateral portions; its breadth and hight steadily increases throughout both these sections and the following one, until it becomes nearly half an inch broad, but in the section from nearer the middle it is low and narrow, and decreases rapidly toward the end. The lateral costæ are well marked, considerably elevated, and well rounded; they run at first close to and

nearly parallel with the midrib, but after the first 3 inches they diverge quite regularly to the point, at 25 inches from the end, beyond which we cannot trace them, until they reappear in the first part of the anterior section, where they are quite small and soon fade out entirely, at some distance from the extreme end. Near the posterior end, between the principal costæ and the margin, there are on each side two additional costæ, much less distinct, and many faint radiating lines. But these diverge more rapidly, and mostly run into the margin at 6 to 8 inches from the posterior end. The anterior portions and posterior portions are pale yellow or bluff, fading to whitish at the thin margins, and deepening into pale amber at the midrib. Their substance is flexible, translucent, and very thin—scarcely thicker than parchment, except at the midrib and costæ.

The third section evidently came from the middle region, where the shell was thickest and broadest. This piece is 7.50 inches long and 4.10 broad, with a strongly convex midrib, .30 to .35 of an inch broad, running through the center, but without any lateral costæ. In this portion the shell is much thicker and firmer than in the others, and of a decided brownish yellow or dull amber-color, but quite translucent; it is finely striated with close, nearly parallel lines. The breadth and form of this middle portion must remain undetermined for the present. The anterior section is quite incomplete, but is over 10 inches long, and shows an extreme width of about 6 inches, or 5.75 where the lateral costæ disappear. Some of the fragments extend forward 8 inches or more beyond that point, and gradually fade out, both at the ends and lateral margins, into a white, soft but tough, fibrous membrane. So far as this portion is preserved, it indicates a broadly rounded and ill-defined anterior margin.

To this species I refer, with some doubt, the tentacular arm of No. 2, preserved in the museum of Saint John's, Newfoundland. It agrees essentially in form and size, as will be seen from the description and measurements, with the corresponding arms of No. 5. Still, it must be remembered that, as yet, no reliable distinctions have been made out between the tentacular arms of *A. Harveyi* and *A. princeps*.

The total length of the tentacular arm of No. 2 was estimated at 30 to 35 feet. The portion saved measured, when fresh, 579.12^{cm} (19 feet). The circumference of the slender portion was 9^{cm} to 10^{cm}; of the enlarged sucker-bearing part, 15.24^{cm} (6 inches); length of the part bearing suckers, 76.2^{cm} (30 inches); diameter of the largest suckers, 3.17^{cm} (1.25 inches). Calculating from the photograph, the portion bearing the larger suckers was about 45.7^{cm} (18 inches) in length, and about 6.35^{cm} (2.5 inches) broad across the face; distance between attachments of large suckers, 4.27^{cm} (1.68 inches); outside diameter of larger suckers, 2.95^{cm} to 3.18^{cm} (1.16 to 1.25 inches); inside diameter, 1.86^{cm} to 2.54^{cm} (.74 to 1 inch); diameter of the small suckers of the outside rows, 1.02^{cm} to 1.22^{cm} (.40 to .48 of an inch). Mr. Harvey afterwards sent to me a full series of meas-

urements of this arm, as then preserved. It had contracted excessively in the alcohol, and was only 13 feet 1 inch in length (instead of 19 feet, its original length), the enlarged sucker-bearing portion being 27 inches; the large suckers occupied 12 inches; the terminal part bearing small suckers, 9 inches; circumference of slender portion, 3.5 to 4.25 inches; of largest part, 6 inches; breadth of face, among large suckers, 2.5 inches; from face to back, 1.62 inches; diameter of largest suckers outside, .75 of an inch; aperture, .63 of an inch. It will be evident from these measurements, when compared with those made while fresh and from the photograph, that the shrinkage had been chiefly in length, the thickness remaining about the same, but the suckers (which had lost their horny rims, and therefore their size and form) were considerably smaller than the dimensions previously given. Comparing all these dimensions with those of the Logie Bay specimen, and calculating the proportions as nearly as possible, it follows that this specimen was very nearly one-third larger than the latter, but the large suckers appear to have been relatively smaller, for they were hardly one-twelfth larger than in the Logie Bay specimen. As the relative size of the large suckers is a variable sexual character in certain species of squids, it is possible that the difference may be a sexual one in this case.

A few of the horny rings from the small distal and lateral suckers (Plate IV, figs. 3, 3 *a*) were sent to me by Mr. Harvey. These agree well with the corresponding suckers of No. 5.

To this species I formerly referred the jaws and two large suckers from the 'club' of the tentacular arms of the Bonavista Bay specimen (No. 4, see p. 8). In form, size, and proportions the jaws resemble those of the specimen (No. 5) described above, so that the size of these two individuals must have been about the same. These jaws had been dried, and were very badly broken when received, so that only part of their dimensions could be ascertained at first, but I have recently partially repaired them, so as to study them more fully (see table under *A. princeps*). The total length of the upper mandible was about 105^{mm}; tip of beak to notch, 16^{mm}; notch to end of proper cutting edge of alæ, 75^{mm}. The lower mandible (Plate III, figs. 4, 4 *a*) shows both sides of the rostrum and alæ. The notch and tooth are well marked, and the tooth in front of it is narrower and much more elevated on one side than on the other. It is, therefore, quite possible that it belongs to *A. princeps*. The suckers (Plate IV, figs. 1, 1 *a*) had been dried, and have lost their true form, but the marginal rings are perfect, and only 23.4^{mm} (.92 of an inch) in diameter, but though somewhat smaller than in the specimen just described, they have the same kind of denticulation around the margin. Their smaller size may indicate that the specimen was a male, but they may not have been the largest of those on the tentacular arm.

To this species I also refer a young specimen (No. 24) which was found floating at the surface, at the Grand Bank of Newfoundland,

April, 1880, by Capt. O. A. Whitten and crew of the schooner "Wm. H. Oakes," by whom it was presented to the United States Commission of Fish and Fisheries. It furnishes the means of completing the description of parts that were lacking or badly preserved in the larger specimens described above, and especially of the sessile arms and the buccal membranes (Plate VI).

The color of the head, so far as preserved, and of the external surfaces of the sessile arms, is a rather dark purplish brown, due to minute crowded specks of that color, thickly distributed, with a pinkish white ground-color between them. The outer buccal membrane is darker; the inner surfaces of the arms are whitish; the peduncular portions of the tentacular arms have fewer color specks, and are paler than the other arms.

This creature had been badly mutilated, as described on p. 18, long before its death, as its healed wounds show, and to this circumstance many of the imperfections of the specimen are due.

Sessile arms.

With the exception of the left arm of the second pair, none of the sessile arms have their tips perfect. Therefore, it is not possible to give their relative lengths.

The dorsal arms are the smallest at base, and the third pair largest. They are all provided with a rather narrow marginal membrane along each border of the front side. These membranes are scarcely wide enough to reach to the level of the rims of the suckers, though they may have done so in life. The front margin, bearing the suckers, is narrow on all the arms, but relatively wider on the ventrals than on any of the others. Each sucker-pedicel arises from a muscular cushion that is slightly raised and rounded on the inner side; these, alternating on the two sides, leave a zigzag depression along the middle of the arm; from each of these cushions two thickened muscular ridges run outward to the edge of the lateral membranes, one on each side of the pedicels of the suckers. These transverse muscular ridges give a scalloped outline to the margin of the membranes. These marginal membranes are narrowest and the suckers are smallest on the ventral arms. The dorsal and lateral arms are strongly compressed laterally, but slightly swollen or convex in the middle, and narrowed externally to a carina, which is most prominent along the middle of the arms, and most conspicuous on the third pair of arms. The dorsal arms are rather more slender than the second pair, and were probably somewhat shorter.

The left arm of the second pair has the tip preserved, with all its suckers present. On this arm there are 330 suckers in all. The total length of the arm is 26.25 inches. The first 50 suckers extend to 12.25 inches from the base; the next 50 occupy 4.5 inches; the next 50 cover 3.5 inches; the next 100 occupy 4.25 inches; the last 80 occupy 1.75 inches. This arm is .80 of an inch in transverse diameter near the base; 1.20

inches from front to back; breadth of its front or sucker-bearing surface (without the lateral membranes) is, where widest, near the base of the arm, .50 of an inch; the width gradually decreases to .18 of an inch at 20 inches from the base; beyond this the arm tapers to a very slender tip, with numerous small, crowded suckers in two regular rows. At the base (Plate VI, fig. 4) there is first one very small sucker; this is succeeded by two or three much larger ones, increasing a little in size; beyond these are the largest suckers, extending to about the 25th, beyond which they gradually change their form and regularly diminish in size to the tips. The larger proximal suckers, up to the 25th to 30th, are relatively broader than those beyond, and have a wider and more open aperture, and a more even and less oblique horny ring, which is sharply denticulate around the entire circumference, with the denticles rather smaller on the inner than on the outer margin, but similar in form. These are about .31 of an inch in external diameter. They show a gradual transition to those with more oblique rims and smaller apertures. Beyond the 30th the horny rims become decidedly more oblique and one-sided, with the denticles nearly or quite abortive on the inner side, and larger and more incurved on the outer margin, while the aperture becomes more contracted and oblique. At first there are eight to ten denticles on the outer margin, but these diminish in number as the suckers diminish in size, till at about 6 inches from the tip there are mostly but two or three, and the aperture is very contracted. Still nearer the tip there are but two blunt ones; then these become reduced to a single bilobed one; and finally only one, which is squarish, appears in the minute suckers of the last two inches of the tip. The first two or three suckers at the base of the arm are more feebly denticulated than those beyond, with smaller apertures.

On many of the suckers (Plate IV, fig. 2 *a*) there are still remaining, in more or less complete preservation, a circle of minute horny plates, arranged radially, or transversely on the edge of the membrane around the aperture, similar in arrangement to those described in another part of this article on the suckers of *Sthenoteuthis pteropus* (Plate XVII, fig. 9). They are less developed, however, than in that species, being thinner and more delicate, nor do their ends appear to turn up in the form of hooks. They seem to be generally very thin, oblong, scale-like structures, with rounded or blunt ends and slightly thickened margins. These structures will probably be found to vary with age, and perhaps with the season. They appear to be easily deciduous, and are often absent in preserved specimens.

On the dorsal and third pairs of arms the suckers have essentially the same arrangement, form, and structure, and on these three pairs of arms the larger suckers differ but slightly in size. The character and arrangement of the suckers on the distal portion of these arms is well shown on Plate VI, figs. 3, 3 *a*, which represent a portion of one of the third pair of arms, commencing at the 67th sucker.

The ventral arms are trapezoidal in section at base, and rather stout. Breadth of front surface, near the base, exclusive of membranes, .55 of an inch; transverse diameter, .95 of an inch; front to back, 1.25 inches. The sucker-bearing surface is, therefore, broader than in the other arms. The suckers are, however, distinctly smaller, and the proximal ones are different in form from the corresponding ones on the other arms. They are narrower and deeper, with more oblique and more contracted apertures, more oblique horny rims, which are denticulated on the outer margins only. On the larger ones there are 12 to 15 sharp, incurved denticles. In fact, the proximal suckers on the ventral arms agree better with the middle suckers, beyond the 30th, on the other arms, for there are none having wide-open apertures, surrounded by nearly even horny rims, denticulated all around. The suckers diminish regularly in size, and in the number of denticles, till at the 200th (where the arms are broken off) there are but three denticles.

Young A. Harveyi, No. 24.—Measurements of arms (in inches).

		Near base.	At 5 in.	At 10 in.	At 15 in.	At 20 in.
DORSAL PAIR.						
Breadth of front, excluding membranes		.35	.50	.30		
Breadth of lateral membranes		.20	.30	.20		
Diameter, transversely		.75	.60	.40		
Diameter from front to back		1.05	.90	.70		
SECOND PAIR.						
Total length	26.25					
Breadth of front		.40	.50	.35	.22	.18
Breadth of membranes		.25	.30	.15		
Diameter, transversely		.80	.65	.35	.30	.16
Diameter, front to back		1.20	1.20	.85	.60	.40
THIRD PAIR.						
Breadth of front		.50	.50	.40		
Breadth of membranes		.20	.25	.15		
Diameter, transversely		1.10	.70	.40		
Diameter, front to back		1.08	1.60	1.20		
FOURTH PAIR.						
Breadth of front		.40	.55	.30		
Breadth of membranes		.20	.25	.10		
Diameter, transversely		.98	.90			
Diameter, front to back		1.40	1.12			
TENTACULAR ARMS.						
Total length	67					
Base to expansion of club	58.75					
Diameter of slender portion	.46					
Length of club	8.25					
Length of part occupied by 24 largest suckers	4.25					
Length of part occupied by small distal suckers	2.60					
Greatest breadth of club	.70					
Diameter, front to back	.60					

Sessile arms, from base to particular suckers.

	To 25th.	To 50th.	To 100th.	To 150th.	To 200th.	To 250th.	To 300th.	To tip.
Dorsal pair, base to suckers	7.5	12.25						
Second pair, base to suckers	7.75	12.25	16.75	20.25	22.90	24.50	25.75	26.25
Third pair, base to suckers	7.25	12.25						
Fourth pair, base to suckers	6.25	10	16.50	20.75				

Measurements of suckers of sessile arms (in inches).

	15th.	30th.	50th.	100th.
On first pair of arms, external diameter	.31	.24	.16	.....
On first pair of arms, aperture diameter	.25	.15	.10	.....
On second pair of arms, external diameter	.31	.27	.20	.15
On second pair of arms, aperture diameter	.25	.18	.11	.08
On third pair of arms, external diameter	.31	.28	.22	.....
On third pair of arms, aperture diameter	.22	.18	.12	.....
On fourth pair of arms, external diameter	.25	.21	.16	.14
On fourth pair of arms, aperture diameter	.15	.11	.10	.07

Tentacular arms.—(Plate VI, fig. 2.)

The tentacular arms are both entire, with all the suckers well preserved. The total length is 65 and 67 inches respectively; length of the expanded portion or club, 8.25 inches; diameter of the peduncular portion varies from .40 to .70 of an inch; at the base, .90 inch; breadth of the proximal part of the club, where it is broadest, .70 inch; diameter, from front to back, 60 inch; external diameter of the largest suckers, .35 inch; height of their cups, .28 inch; of lateral suckers, .18 inch; of the largest marginal suckers on the distal portion, .14 inch.

The peduncular portion is somewhat thickened and rounded at the base, but through most of its length it is slender, varying in size, and nearly triangular in section, with the corners rounded, each side measuring, where largest, .60 of an inch in breadth. At about a foot from the base the small smooth-rimmed suckers and their opposing tubercles begin to appear on the inner surface. At first these are placed singly and at considerable intervals (2.5 to 3.5 inches), each sucker alternating with a tubercle on each arm; farther out they are nearer together, and toward the club they alternate, two by two, on each arm; near the commencement of the club they become more numerous, and are arranged somewhat in two rows; just at the commencement of the club they become more crowded, forming three and then four oblique transverse rows of suckers, with the same number of tubercles alongside of them; on the basal expansion of the club, which is its thickest portion, these suckers and tubercles become very numerous, covering nearly the whole inner surface, forming rather crowded and irregular oblique rows of six or more. These smooth-rimmed suckers are followed by an irregular group of about twenty, somewhat larger, denticulated suckers, occupying the entire breadth for a very short distance. Then follow the two median rows of large suckers, alternating with a row of marginal ones, of about half their size, on each side. The first three or four large suckers of each row gradually increase in size; then follow six to eight nearly equal ones of the largest size; these are followed by two to four distal ones, decreasing in size. In one of the rows there are fourteen that distinctly belong to the large series; in the other row there are twelve. The distal section of the club is occupied by four regular

rows of small denticulated suckers, more strongly toothed on the outer margins, and similar in form to the marginal suckers of the middle region. Of these the two rows next the lower margin are decidedly larger than those of the two upper rows. Close to the tip there is a group of about a dozen minute suckers, with smooth even rims. The middle portion of the club is bordered on each side by a rather broad, thin, scalloped membrane. The distal section has a broad keel on the outer margin.

Suckers of tentacular arms (in inches).

Diameter of largest suckers	.35
Hight of largest	.28
Diameter of lateral	.18
Hight of lateral	.09
Diameter of smooth-rimmed ones	.10
Diameter of tubercles	.08
Of largest lateral suckers of distal section	.14
Of median lateral ones of distal section	.11

Buccal membranes and jaws.—(Plate VI, fig. 1.)

This specimen fortunately had the buccal membranes and other parts about the mouth perfectly preserved, which has not been the case in the larger specimens. The outer buccal membrane is broad and thin, rather deeply colored externally. Its margin extends into seven acute angles, one of which is opposite each of the lateral and ventral arms; but on the dorsal side there is only one, which corresponds to the interval between the two dorsal arms. From each of these angles a membrane runs to, and for a short distance along the side of, the opposite arm, except from the dorsal one, which sends off a membrane which divides, one part going to the inner lateral surface of each dorsal arm. The membranes from the upper lateral and ventral angles join the upper lateral sides of their corresponding arms; those from the lower lateral angles go to the lower lateral sides of the third pair of arms. The inner surface of the buccal membrane is whitish, and deeply and irregularly reticulated by conspicuous soft wrinkles and furrows, which become somewhat concentric toward the margin. Beneath this membrane are openings to the aquiferous cavities. The inner buccal membrane, immediately surrounding the beak, is whitish, thickened at the margin, and strongly irregularly wrinkled and puckered.

The jaws have sharp, dark brown tips, changing to clear brown backward, with the laminæ very thin, transparent, and whitish. The upper mandible has the rostrum regularly curved, with a distinct ridge, in continuation with its cutting edges, extending down the sides, and only a slight notch at its base.

The lower mandible has a notch close to the tip, with the rest of the

inner edge nearly straight; at the base is a rather large and wide, V-shaped notch, the tooth beyond it being broad-triangular and rather large; beyond the tooth the alæ are white, soft, and cartilaginous.

Measurements of jaws (in inches).

Transverse diameter of buccal mass	1.50
Vertical diameter of buccal mass	1.70
Upper mandible:	
Tip to end of frontal lamina	1.25
Tip to notch	.57
Tip to lateral border of lamina	.77
Lower mandible:	
Tip to border of mentum	.45
Tip to lateral border of alæ	.70
Tip to inner end of alæ	1.02
Tip to bottom of notch	.32
Hight of tooth	.06
Notch to inner end of alæ	.80
Mentum to inner end of alæ	1.20

The portion of the œsophagus preserved is 14.75 inches long and about .15 of an inch broad, in its flattened condition.

The radula (Plate V, figs. 5–7) is amber-colored, .18 of an inch broad. The tridentate median teeth have moderately long but not very acute points, of which the middle one is a little the longest. The inner lateral teeth are bidentate, and somewhat broader and longer than the median ones; their outer denticle is well developed, but considerably shorter than the inner one. The next to the outer lateral teeth are larger at base and much longer, simple, broad, tapering, flattened, slightly curved, acute at tip. They appear not to have the small lateral denticle observed on the corresponding teeth of the adult *Architeuthis* (see Plate V, figs. 1, 2). The outer lateral teeth are similar to the preceding, but rather longer and not quite so broad at base. The marginal plates are well-developed, thin, somewhat rhomboidal.

The internal cavity of the ears is somewhat irregularly three-lobed, with several rounded papillæ projecting inward from its sides, very much as in those of *Ommastrephes*. Each ear contained two irregular-shaped otoliths, one of which (Plate V, fig. 8) was much larger than the other, in each ear.

The eyes were both burst, and most of their internal structure was destroyed. So far as preserved they closely agree with those of *Ommastrephes*. The eyeballs were large and somewhat oblong in form, and appear to have been nearly 2 inches broad and 3 long. The eyelids are badly mutilated, but the anterior sinus can be imperfectly made out. It seems to have been broad and rounded. The aquiferous cavities appear to have been like those of *Ommastrephes*. The form and structure of the cartilaginous 'brain-box' also appear to be essentially the same as in the genus last named.

Architeuthis princeps Verrill.—(King of Giant Squids.)

Architeuthis princeps Verrill, Amer. Jour. Science, vol. ix, pp. 124, 181, pl. 5, 1875. American Naturalist, vol. ix, pp. 22, 79, figs. 25–27, 1877. Trans. Conn. Acad., vol. v, p. 210, pl. 17–20, 1879–'80. Amer. Jour. Science, vol. xix, p. 288, pl. 12, April, 1880.

Ommastrephes (*Architeuthis*) *princeps* Tyron, Manual of Conchology, p. 185, pl. 85, 1879. (Figures copied and description compiled from papers by A. E. V.)

Plates VII–XI.

This species is distinguished by the length and inequality of the short arms, of which the longest (ventral or subventral) exceed the combined length of the head and body by about one-sixth; by the denticulation of the suckers of the short arms, of which there are two principal forms, some having very oblique horny rings, with the outer edge very strongly toothed and the inner edge slightly or imperfectly denticulated; the others having less oblique rings, with the denticles similar in form all round, though smaller on the inner margin; by the stronger jaws, which have a deeper notch and a more elevated tooth on the anterior edge; and by the caudal fin, which is short-sagittate in form, with the posterior end less acuminate than in the preceding species.*

This species was originally based on the lower jaw mentioned as No. 1, and on the upper and lower jaws designated as No. 10, in the first part of this article. The jaws of No. 10 were obtained from the stomach of a sperm-whale taken in the North Atlantic, and were presented to the Essex Institute by Capt. N. E. Atwood, of Provincetown, Mass., but the date and precise locality of the capture are unknown. The size and form of these jaws are well shown in Plate XI, figs. 1, 2. The total length of the upper jaw (fig. 1) is 127^{mm} (5 inches); greatest transverse breadth, 37^{mm} (1.45 inches); front to back, 89^{mm} (3.5 inches); width of palatine lamina, 58.9^{mm} (2.32 inches). The frontal portion is considerably broken, but the dorsal portion remaining appears to extend nearly, but not quite, to the actual posterior end, the length from the point of the beak to the posterior edge being 86.4^{mm} (3.4 inches). The texture is firmer and the laminæ are relatively thicker than in *A. Harveyi*. The rostrum and most of the frontal regions are black and polished, gradually becoming orange-brown and translucent toward the posterior border, and marked with faint striæ radiating from the tip of the beak, and by faint ridges or lines of growth parallel with the posterior margin; a slight but sharp ridge extends backward from the notch at the base of the cutting edge, and other less marked ones from the anterior border of the alæ. The tip of the beak is quite strongly curved forward and acute, with a slight shallow groove, commencing just below the tip, on each side, and extending backward only a short distance and gradually fading out. The front or cutting edge is nearly smooth and well curved, the curvature being greatest toward the tip; at its base there is a broad, angular notch, deepest externally. The inner face of the rostrum is con-

* The possibility that this and *A. Harveyi* may be only the sexual forms of one species is fully recognized by the author.

vex in the middle and concave or excavated toward the margins, which are, therefore, rather sharp. The anterior borders of the alæ are convex, or rise into a broad but low lobe or tooth beyond the notch, but beyond this they are nearly straight, but with slight, irregular lobes, which do not correspond on the two sides. The anterior edges of the alæ make nearly a right angle with the cutting edges of the rostrum. The palatine lamina is broad, thin, and dark brown, becoming reddish brown and translucent posteriorly, with a thin whitish border. The surface is marked with unequal divergent striæ and ridges, some of which, especially near the dorsal part, are quite prominent and irregular; the posterior border has a broad emargination in the middle, but the two sides do not exactly correspond.

The lower jaw (Plate XI, fig. 2) was badly broken, and many of the pieces, especially of the alæ, are lost, but all that remain have been fitted together. The extreme length is 92^{mm} (3.63 inches); the total breadth and the distance from front to back cannot be ascertained, owing to the absence of the more prominent parts of the alæ; from tip of beak to posterior ventral border of mentum, 42.6^{mm} (1.68 inches); from tip of beak to posterior lateral border of alæ, 55.9^{mm} (2.20 inches); from tip of beak to posterior ventral border of gular lamina, 60^{mm} (2.37 inches); from tip of beak to bottom of notch at its base, 20^{mm} (.80 inch); tip of beak to inner angle of gular lamina, 47^{mm} (1.85 inches); height of tooth from bottom of notch, 6.25^{mm} (.25 inch); breadth between teeth of opposite sides, 15^{mm} (.60 inch); breadth of gular lamina, in middle, 44.5^{mm} (1.75 inches). The beak is black, with faint radiating striæ, and with slight undulations parallel with the posterior border; the rostrum is acute, slightly incurved, with a notch near the tip, from which a very evident groove runs back for a short distance, while a well-marked angular ridge starts from just below the notch and descends in a curve to the ala, opposite the large tooth, defining a roughened or slightly corrugated and decidedly excavated area between it and the cutting edges; the cutting edge below this ridge is nearly straight, or slightly convex; the notch at its base is rounded and deep and strongly excavated at bottom; the tooth is broad, stout, obtusely rounded at summit, sloping abruptly on the side of the notch, and gradually to the alar edge. The anterior edge of the ala, beyond the tooth, is rounded and strongly striated obliquely; it makes, with the cutting edge, an angle of about 110°. The inner surfaces of the two sides of the internal plate of the rostrum form an angle of about 45°.

The lower jaw of No. 1 (Plate XI, figs. 3, 3 *a*) is represented only by its anterior part, the alæ and gular laminæ having been cut away by the person who removed it.* It agrees very well in form and color with the corresponding parts of the one just described, but is somewhat smaller. The lateral ridges of the rostrum are rather more prominent, and the

*The specimen was given to the Smithsonian Institution by Mr. G. P. Whitman, of Rockport, Mass., in 1872. (No. 2524.)

area within it is narrower and more deeply excavated, especially at the base of the notch, where the excavation goes considerably lower than the inner margin. The notch is narrower and not so much rounded at its bottom. The tooth is about the same in size as that of No. 10, and appears to be even more prominent, because the anterior edge of the ala is more concave at its outer base; it is also more compressed and less regularly rounded at summit. This jaw measures 32.5^{mm} (1.30 inches) from the tip to the posterior ventral border of mentum; 17^{mm} from the tip to the bottom of the notch; 4^{mm} from bottom of notch to the tip of the tooth.

Both these lower jaws agree in having a very prominent tooth on the alar edge, with a large and deeply excavated notch between it and the cutting edge of the beak, and in this respect differ from the lower jaw of *A. Harveyi*, for in the latter the tooth or lobe is broad and less prominent, while the notch is narrower and shallower. This seems to be the best character for distinguishing the jaws of the two species. But they also differ in the angle between the alar edge and the cutting edge of the rostrum, especially of the lower jaw, for while in *A. Harveyi* this is hardly more than a right angle, in *A. princeps* it is about 110°. Moreover, the darker color and firmer texture of the jaws of the latter seem to be characteristic.

To this species I have referred the Catalina specimen (No. 14, p. 13), preserved in the New York Aquarium. The jaws of the latter, which were examined and carefully measured by me, agree very closely, both in form and size, with those of No. 10, the type of the species, but are a trifle larger. The total length of the upper mandible is 133^{mm}; greatest breadth, 99^{mm}; from inner angle of anterior edge to the dorsal end of frontal lamina, 95^{mm}; tip of rostrum, or beak, to the dorsal end of frontal lamina, 92^{mm}; tip of rostrum to bottom of notch, 19^{mm}; notch to inner end of anterior edge, 38^{mm}; transverse breadth between anterior edges, 17^{mm}.

The total length of the lower mandible is 95^{mm}; breadth from gular lamina to inner end of alæ, 99^{mm}; front edge of jaw to posterior end of gular lamina, 83^{mm}; breadth of alæ, 41^{mm}; posterior edge of alæ to end of gular lamina, 44.5^{mm}; tip of beak to bottom of notch, 22^{mm}; notch to inner angle of alæ, 70^{mm}; depth of notch, 3.5^{mm}.

The general form of this species is very well shown on Plate VIII. This figure has been made from the sketches and measurements made by me soon after the specimen was received in New York and before it had been "mounted" (see p. 13). The head was, however, so badly injured that it could not be accurately figured, and this part is, therefore, to be regarded as a restoration, as nearly correct as could be made under the circumstances. It may require considerable corrections, both as to size and form. The caudal fin is remarkable for its small size, as in *A. Harveyi*. Its breadth is scarcely more than that of the greatest diameter of the body. It is short-sagittate in form, with strongly divergent side lobes, which extend forward beyond their lateral insertions, and end in

a rounded or blunt angle. The posterior end is somewhat prolonged and acute, but less so than in that of *A. Harveyi*, which it otherwise resembles. One of the figures (Plate X, fig. 2), was made by me several weeks after it had been placed in strong alcohol, and had shrunk considerably; the other (fig. 1) was made by Dr. J. B. Holder after it had been in alcohol only a few days.

When fresh, the caudal fin was 84^{cm} in breadth, but when sketched by Dr. J. B. Holder its breadth was 71^{cm}; its length, from posterior tip to lateral insertions, 48.3^{cm}; from tip to end of lateral lobes, 61^{cm}.

The length of the body and head together, when fresh, was about 289^{cm} (9.5 feet), but when measured by me it was about 218^{cm}.

The sessile arms were unequal in size and length, the longer ones considerably longer than the head and body together. Mr. Harvey found that the longest arms, said to be the ventral ones, were 335^{cm} (11 feet) long and 43.2^{cm} (17 inches) in circumference at base. When first examined by me the ventral arms measured 10.5 feet, and were longer than any of the others, but all the rest were more or less mutilated at the tips, and several had thus lost a considerable portion of their length, so that it is quite probable that originally the subventral arms (or third pair) were actually longer than the ventral ones. The circumference of the third pair of arms, when measured by me, was considerably greater than that of the ventral ones, the former being 11.25 inches, the latter 10 inches. Hence, I have inferred that the greatest circumference (17 inches), measured by Mr. Harvey, applies to the third pair of arms.

The ventral arms have both outer angles bordered by a strong, thick marginal membrane about an inch wide. The arms are all more or less trapezoidal in form, and taper to very slender tips. When examined by me they had already lost nearly all their suckers. A few remained near the base of one of the arms of the third pair. These were 25^{mm} (1 inch) in diameter, with the aperture 15.5^{mm} (.62 inch) across; the denticles on the outer border of the marginal ring were broad-triangular, acute, and strongly incurved, much larger than those on the inner margin.

Of the detached suckers, I have been able to study with care 18 specimens from the sessile arms. Part of these are represented only by the horny marginal rings. The three largest differ from the rest in having the denticles less incurved and more nearly alike all around the margin, those on the inner edge being only somewhat smaller and more slender than those on the outer margin, while the rings themselves are less oblique and eccentric. These probably came from the basal half of the lateral arms. The other suckers all belong to one type, like those seen upon the third pair of arms, described above. They differ, however, very much in size, in the number of denticles, and in the presence or absence of more or less perfect denticles on the inner margin, this, in the smaller ones, often being without any distinct denticles whatever; the horny rings are very oblique and the aperture eccentric. Suckers of this kind probably originally occupied the entire length of the ventral

arms and the distal half of the other arms. The diameters vary from 8mm to 24mm externally; the apertures from 3.5mm to 20mm.

One of the most perfect of these suckers (*b*) is preserved in alcohol, with the soft parts (Plate IX, figs. 5, 6), and was sent to me from Newfoundland by Mr. Harvey. This has the greatest external diameter 22mm; diameter of aperture, 10mm; height of cup (outside), 16mm; height at center, 15mm; height near inner margin, at attachment of pedicel, 6mm; length of pedicel, 14mm; diameter of pedicel, 1.5mm. In a side-view the sucker is oblique and gibbous; the lower surface is convex centrally, but has a deep notch or pit near the front margin, in the bottom of which the slender but strong pedicel is attached, and the horny ring has a corresponding notch; the outer or back portion is much swollen and produced downward and backward, and here the horny ring is correspondingly high. The aperture is nearly circular, but is rather shorter from front to back than transversely. In this and some of the other suckers of similar size the entire circumference of the margin is furnished with rather large, sharp dentieles, which are strongly inclined inward and considerably larger on the outer than on the inner margin. There are about thirteen of the large teeth, occupying rather more than half the circumference; these are broad at base, beveled off to an acute edge on the sides, and somewhat acuminate, with sharp tips. Those on the middle of the outer border point inward to the center of the sucker, but those along the sides point rather obliquely to the front margin. The front margin is occupied by about seventeen smaller, unequal, acute denticles, those in its center the smallest and most regular; these are acute-triangular and their points are directed more upward than those of the opposite edge. The horny rings are light yellow (when dried they are white and osseous), their dentieles yellowish white, and often silvery white and lustrous at tip and along their edges, especially when dried. The large suckers of this form I refer to the basal half of the lateral and dorsal arms. The suckers smaller than the above have fewer of the larger outer teeth, and usually fewer and less perfectly formed teeth along the front margin. Those that have the aperture 7mm or less in diameter usually have the front margin of the ring only irregularly fissured, with the intervals minutely dentieulate or crenulate, while the outer half of the margin may bear nine or ten large and well-developed denticles, with broad, stout bases and sharp edges and tips; the edges of these teeth along the middle are usually convex, and then the outline is incurved to the acute point. One of the smaller suckers examined has the aperture about 4.5mm in diameter, with the same form as the larger ones; this has about six large, sharp denticles, like those above described, on the outer half of the margin of the rings, while the front margin is nearly entire and smooth. The smallest one (*j*) is similar, with but four distinct large dentieles, with another imperfect, lobe-like one on one side, and with a smooth front margin. These probably came from the distal half of the various arms.

The three largest suckers (Plate IX, fig. 9), supposed to be from near the base of the lateral arms, have about 45 marginal denticles, of nearly uniform size, and less incurved than in those above described. In these the back side of the horny ring is less expanded, and therefore the suckers were less oblique than in the smaller ones. The largest of these (*a*) had the aperture 20^{mm} in diameter.

Measurements of suckers of short arms (in millimeters).

	a.	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*	*i.*	*j.*
Transverse diameter, outside	24	21	20	20	17	16	16	10	9.5	8
Diameter of aperture, inside	20	10.5	9	9	8.5	8	7	5	4.5	3.5
Hight of horny ring, back side	10	.....	11	12	11	11	11	.....	7	5
Hight of horny ring, front side	5	.....	3.5	3	3	2.5	3	.....	2	1.5
Number of large denticles	23	13	12	12	9	12	10	7	6	4
Number of small denticles	22	17	10	17	12	15	.....	.....	.....	.....

The long tentacular arms agree very closely with those of *A. Harveyi* (No. 5) in form and in the arrangement of the suckers on the 'club.' When fresh they measured 914.4^{cm} (30 feet) in length, with a circumference of about 12.7^{cm} (5 inches), except at the enlarged club, which was 20.32^{cm} (8 inches) in the middle. But when first examined by me they had shrunk to 731.5^{cm} (24 feet) in length, and the circumference of the slender portion was 9^{cm} to 10^{cm}; that of the club was 15.24^{cm} (6 inches). At that time the club was 77.47^{cm} (30.5 inches) long; that portion bearing the larger suckers was 48.26^{cm} (19 inches); the wrist or portion bearing the smaller and partly smooth-rimmed suckers and tubercles was 15.24^{cm} (6 inches) long; the terminal portion, bearing small denticulated suckers, was 22.86^{cm} (9 inches); the breadth of the front of the club was 7.62^{cm} (3 inches). The terminal portion had a strong carina-like membrane or crest along the back, and was here 5^{cm} (2 inches) wide from front to back.

The large suckers (Plate IX, figs. 1, 1 *a*) of the tentacular arms are nearly circular in outline, and are broad, depressed, little oblique, constricted just below the upper margin, and then swelled out below the constriction to the base. The calcareous ring is strong, white, and so ossified as to be somewhat rigid and bone-like. The margin is surrounded by numerous (about 45 to 50) nearly equal, acute-triangular teeth, sometimes separated by spaces equal to their breadth, at other times nearly in contact at their bases; their edges are so beveled as to be sharp, while there is a triangular thickening in the middle of each at base. A wide, deep, and concave groove extends entirely around the rim a short distance below the margin; below this the lower part of the rim is somewhat expanded and irregularly plicated, varying in width. The largest ring examined by me measures 31^{mm} in its greatest diameter externally; the aperture is 26^{mm} and 23^{mm} across its longer and shorter diameters;* greatest hight or breadth of rim, 11^{mm}; least hight, 8^{mm}; breadth of groove, 1.5^{mm} to 2^{mm}.

* This specimen is somewhat warped by drying, so that the aperture is not so circular as when fresh.

The marginal suckers (Plate IX, fig. 10), alternating with the large ones on the club, are very oblique, with the rings strong and very one-sided, the height of the back being more than twice that of the front margin. The aperture is not circular, the outer portion of the margin being incurved or straight. The groove below the margin is narrow and deep, especially on the sides, but only extends around the front and sides, being entirely absent on the outer third of the circumference. The denticles are about 22 to 24, slender, acute, not crowded, the most of them being separated by spaces greater than their breadth at base. The outer ones are strongly incurved; those along the sides are curved forward obliquely toward the front margin, while those on the front margin point upward and sometimes rather outward. The denticles are of nearly equal length, but those of the front margin are both more slender and more acute; they all have sharp, beveled edges and a thickened median ridge or tubercle. The largest ring examined was 14^{mm} in diameter; height or breadth of back side of rim, 8^{mm}; of front side, 3.5^{mm}.

The small suckers, covering the last division of the club, are very similar to the marginal ones last described, except that they are much smaller and more delicate, with a narrower and less oblique rim. The denticles of the inner margin are very acute, and point obliquely outward and upward. Greatest diameter of the one described, 6^{mm}; hight of back side of rim, 4^{mm}; of front side, 1.5^{mm}.

The small terminal group of smooth rimmed suckers, seen in No. 5, were not noticed, but they were not looked for specially.

To this species I have also referred the specimen (No. 13) from Grand Bank, Fortune Bay (see p. 12, where the general measurements are given). Fortunately, Mr. Simms was able to obtain the jaws in pretty good condition, and also one of the largest suckers of the tentacular arms. These specimens were forwarded to me by the Rev. M. Harvey. They had been dried, and the jaws, which were still attached together by the ligaments, had cracked somewhat, but all parts were present except the posterior end of the palatine lamina, which had been cut or broken off. Although these jaws had undoubtedly shrunken considerably, even when first received, they were afterwards put into alcohol and have since continued to shrink, far more than would have been anticipated, so that, at present, the decrease in some of the dimensions amounts to 20 per cent., while even the harder portions have decreased from 5 to 10 per cent. from the measurements taken when first received by me.* When first received, in 1875, the upper mandible measured

* There is no reason to suppose that the shrinkage has been any more in this case than in the others, but I have not had an opportunity for making comparative measurements from the same specimens when recently preserved, and again after long preservation in alcohol, except in one other instance (No. 5), in which a similar shrinkage was evident. (See table of measurements, p 22.)

111mm in total hight or breadth; 88mm from tip of beak to anterior end of palatine lamina; 20mm from tip of beak to the bottom of the notch. The lower mandible measured 96mm in total length; 80mm from tip of beak to inner end of alæ; 19mm from tip to bottom of notch.

At the present time (January, 1880), the breadth of the upper mandible is about 90mm; from tip of beak to anterior end of palatine lamina (at junction with anterior edge of alæ), 89mm; tip of beak to bottom of notch, 19mm; breadth of palatine lamina, 58mm; beak to posterior end of frontal lamina, 90mm; beak to posterior lateral edge of alæ, 43mm; notch to end of anterior edge of alæ, 33mm; notch to end of hardened or black portion of same (proper cutting edge), 17mm; transverse breadth at notches, 16mm. The lower mandible measures, in length, 82mm; beak to inner end of alæ, 67mm; to bottom of notch, 18mm; breadth, alæ to mentum, 78mm; end of alæ to outer side of gular lamina, 84mm; inner side of gular to mentum, 50mm; breadth of gular, 44mm; breadth of alæ, anterior to posterior edge, laterally, 29mm; tip of beak to posterior ventral end of mentum, 33mm; tip to posterior lateral border of alæ, in line with cutting edge of rostrum, 45mm; posterior lateral border of alæ to end of gular, 40mm; depth of notch, 3mm; breadth of tooth, 8mm; notch to end of cutting or hardened edge of alæ, 20mm; to inner end of alæ, 55mm; breadth transversely, across teeth, 16mm. (See also the following table of measurements of jaws).

The beak of the upper mandible is sharp, strongly and regularly curved, most so near the tip; a radial ridge runs from the notch to the lateral borders of the alæ; the anterior or cutting edges of the alæ are somewhat convex and irregularly crenulate. The lower mandible has a sharp beak, with a slight notch close to the tip; the cutting edges of the rostrum are otherwise nearly straight; the notches at the base are deep and narrow V-shaped. The teeth are rather prominent, obtuse, slightly bilobed at the summit; the one on the right side of the mandible is more prominent than the other, owing to the fact that the edge of the ala, beyond it, is more concave in outline. There is also a broad and slightly prominent lobe in the middle of the anterior edges of the alæ. The sides of the rostrum are strongly excavated toward the base and around the notches, and radially striated. The jaws are dark brown, becoming blackish toward the tips.

*Comparative measurements of jaws (in inches).**

	A. Harveyi.			A. princeps.				
	No. 4.	No. 5, when received.	No. 5, later.	No. 1.	No. 10.	No. 13, fresh.	No. 13, preserved.	No. 14.
UPPER MANDIBLE.								
Length, beak to end of palatine	3.55	.....	3.85	.....	5	.....	3.75+	5.25
Greatest breadth, palatine to frontal	2.49+	2.84	2.60	.....	3.50+	4.50	3.54+	3.88
Greatest transverse diameter	.....	.....	1	.....	1.45	.....	1.15	.....
Inner end of alæ to dorsal end of frontal	.....	.....	2.50	.....	3+	.....	2.95+	3.75
Tip of beak to samo	2.37+	.....	2.55	.....	3.40+	.....	3.17	3.62
Tip to anterior end of palatine lamina	.....	2.06	.....	.....	.....	3.57	.....	.....
Tip to bottom of notch	.63	.69	.61	.....	.75	.81	.75	.75
Notch to end of anterior edge of alæ	.....	.....	1.10	.....	1.15	.....	1.30	1.50
Transverse breadth at notch	.60	.....	.....	.....	.....	.....	.63	.....
Transverse breadth between edges of alæ	.....	.....	.....	.....	.....	.....	1	.69
Breadth of palatine lamina	.....	.....	1.70	.....	2.32	.....	2.30	.....
End of palatine to edge of frontal lamina	.....	.....	2.20	.....	3.15	.....	.....	3.50
Beak to posterior edge of alæ, laterally	.....	.....	1.40	.....	1.95+	.....	1.70	.....
LOWER MANDIBLE.								
Total length, beak to end of gular	.....	3.44	3	.....	3.63	3.89	3.24	3.75
Mentum to inner end of alæ	2.60+	.....	2.55	.....	.....	.....	3.08	.....
Total breadth, gular lamina to end of alæ	.....	.....	2.65	.....	.....	.....	3.32	3.88
Breadth of gular lamina	.....	.....	1.50	.....	1.75	.....	1.74	.....
Anterior edge of alæ to end of gular lamina	.....	.....	2.45	.....	3.15	.....	2.68	3.25
Tip of beak to end of mentum, medially	.....	.....	.85	1.30+	1.68	.....	1.31	.....
Tip to end of gular lamina, medially	.....	.....	1.85	.....	2.37	.....	2.40	.....
Breadth of alæ, laterally	1.18	.....	.93+	.....	1.50	.....	1.15	1.62
End of gular lamina to alæ, laterally	.....	.....	1.50	.....	1.60	.....	1.58	1.75
Tip of beak to bottom of notch	.62	.69	.60	.67	.80	.77	.71	.87
Tip to posterior edge of alæ, laterally	1.67	.....	1.50+	.....	2.20	.....	1.78	.....
Tip to inner end of alæ	2.33	2.63	2.10+	.....	.....	3.45	2.67	.....
Tip to inner angle of gular lamina	1.20	.....	1.18	.....	1.85	.....	1.28	.....
Notch to inner angle of alæ	1.92	.....	1.77	.....	.....	.....	2.17	2.75
Depth of notch	.12	.....	.12	.15	.15	.....	.12	.13
Breadth of tooth in front of notch	.30	.....	.....	.35	.32	.....	.32	.38
Spread of jaws between teeth	.....	.....	.....	.....	.60	.....	.64	.....

* Nos. 1 and 10 had been dried for many years. All the others had been preserved in alcohol—Nos. 4 and 13 for several years; No. 5 about one year; No. 14 for only a few days. The amount of shrinkage is considerable in those preserved long in alcohol or dried.

Comparative measurements of Architeuthis Harveyi and A. princeps (in inches).

	No. 5. A. Harveyi.		No. 2. A. Harveyi.		No. 14. A. princeps.	
	Fresh.	Preserved.	Fresh.	Preserved.	Fresh.	Preserved.
Total length, to tips of short arms	166?	.....	.....	.....	246	212
Total length, to tips of tentacular arms	382?	.....	.....	.....	480	372
From base of arms to tip of tail	92?	.....	.....	.....	114	86
From base of arms to origin of fins	75?	.....	.....	.....	95	67
Head, from base of arms to mantle (above)	10?	.....	.....	.....	14?	12
Body, edge of mantle to tip of tail (above)	82	.....	.....	.....	100?	74
Tip of tail to insertion of fin	18?	17	.....	.....	.....	19
Breadth of caudal fin	22	16	.....	.....	33	28
From end of body to outer angle of fin	27?	23	.....	.....	.....	24.5
Front edge of fin, outer angle to side of body	2	6.5	.....	.....	.....	10
Circumference of body	66	.....	.....	.....	84	66
Circumference of head	.....	.....	.....	.....	48	.....
Length of tentacular arms	88	161	348?	.....	360	289
Length of sucker-bearing portion	30	30	30	27	36	30.5
Length of dorsal arms (first pair)	72?	.....	.....	.....	.....	81+
Length of lateral arms (second pair)	72?	.....	.....	.....	.....	100+
Length of lateral arms (third pair)	72?	.....	.....	.....	.....	76+
Length of ventral arms (fourth pair)	72	.....	.....	.....	132	126
Circumference of first pair of arms, at base	7	.....	.....	.....	.....	9
Circumference of second pair of arms, at base	8	.....	.....	.....	.....	9.50
Circumference of second pair, 3 feet from base	.....	.....	.....	.....	.....	7.50

Comparative measurements, &c.—Continued.

	No. 5. A. Harveyi.		No. 2. A. Harveyi.		No. 14. A. princeps.	
	Fresh.	Preserved.	Fresh.	Preserved.	Fresh.	Preserved.
Circumference of third pair, at base	10	8	.....	.....	17	11.25
Circumference of third pair, 3 feet from base	.....	.....	.....	.....	.....	9
Circumference of fourth pair, at base	9	7.5	.....	.....	.....	10
Circumference of fourth pair, 4 feet from base	.....	.....	.....	.....	.....	8.5
Circumference of tentacular arms	3.75	2.75	4	3½–4¼	5	4
Circumference of terminal club of same	.....	4.5	6	6	8	6
Diameter of largest sucker of tentacular arms	.....	1.15	1.28	1.25	1.25	1
Diameter of largest sucker of sessile arms	1	.84	.....	.....	1	1
Aperture of latter	.....	.68	.....	.....	.80	.80
DETAILS OF TENTACULAR ARMS.						
Length of 'club' or expanded portion	31	30	30	27	.....	30.5
Of part of club bearing 24 largest suckers	15	14	18	14	.....	19
Of 'wrist' or part with group of small suckers	7	7	.....	.....	.....	6
Of terminal part, with small suckers	9	9	.....	9	.....	9
Breadth of club in middle	.....	1.5	2.5	2.5	.....	3
Breadth of wrist	.....	1.6	2.6	1.5	.....	3
Breadth of slender middle portion	.....	1.15	.....	.....	.....	1.5
Breadth of tip, from front to back	.....	1.75	.....	1.5	.....	2
Circumference of club	.....	4.5	.....	5.5	.....	6
Circumference of wrist	.....	5	.....	6	.....	6
Circumference of middle portions of arm	2¾–3½	2¼–3½	.....	3½–4¼	.....	3½–4
Distance between pedicels of large suckers	.....	1.15	1.68	1.44	.....	.....
Distance between pedicels diagonally	.....	1	1.32	1.31	.....	.....
DETAILS OF SUCKERS OF CLUB.						
Largest suckers, diameter in middle	1.25	1.15	1.28	1.24	1.25	.....
Largest suckers, diameter of horny ring	.....	.92	.....	.....	1.15	1.15
Diameter of facets around suckers	.....	1	.....	1.40	.....	1.25
Largest suckers, hight from attachment	.....	1	.....	.....	.....	.75
Largest suckers, length of pedicels	.....	.40	.....	.....	.....	.50
Largest suckers, hight of ring	.....	.32	.....	.....	.....	.42
Secondary suckers, next to wrist, diameter	.....	.24	.....	.....	.....	.44
Marginal suckers, diameter of rings	.....	.40	.....	.48	.....	.60
Marginal suckers, hight of rings, outer side	.....	.28	.....	.....	.....	.35
Sessile suckers of wrist, diameter	.....	.12	.....	.28	.....	.....
Suckers of terminal section, diameter	.....	1/4–1/16	.....	.....	.....	.....

The dried sucker from the tentacular arm appears to have been one of the largest (Plate IX, fig. 11). At the present time the transverse diameter of the ring, outside, is 28mm; diameters of the edge, 24mm and 22mm; greatest hight of the ring, including denticles, 9.5mm; least hight on inner side, 6.5mm. There are forty-eight marginal denticles, which are nearly the same in size and form all around. They are narrow, triangular, acute, with the edges beveled, sharp, and with a central, thickened, triangular ridge on the outside. The ring is white, hard, smooth, and osseous in appearance.

Of the other specimens enumerated in the first part of this paper, it is probable, judging from the proportions given, that Nos. 16, 18, and 19 also belonged to *A. princeps*. Nos. 18 and 19 appear to have been much larger than any of the examples of which portions have been preserved, and it was very unfortunate that the persons who secured them did not know their value, for they were both found within a few miles of the settlement at Little Bay Copper Mine, on the south arm of Notre Dame Bay, and could easily have been taken to Saint John's.

Observations on the specimens described from foreign localities.

A.—Atlantic ocean species.

We are largely indebted to Professor Steenstrup and to Dr. Harting for our earliest knowledge of the specimens preserved in European museums, or cast ashore on the European coasts. Professor Steenstrup* has given accounts, compiled from contemporary documents, of a specimen taken at Malmö, Sweden, about 1546 or 1549, and of two specimens of huge Cephalopods cast ashore at Iceland, in 1639, and November or December, 1790.

The specimen of 1790, described in the MSS. of Svend Paulsen, 1792, had tentacles 3 fathoms long; the body (with head) was 3½ fathoms long. That of 1639, described in Olafsens og Povelsens Reise til Island, ii, p. 716, was 4 to 5 fathoms long.

In the article published in 1857, he also briefly mentioned a specimen cast ashore at Jutland, December, 1853, of which the jaws were preserved, and on which he then based the species *Architeuthis monachus;* and another specimen, which he named *Architeuthis dux*, taken by Capt. Vilh. Hygom in the Western Atlantic. He has also since described and figured† the jaws of the specimen of *Architeuthis monachus* obtained at Jutland in December, 1853.

In the same memoir, of which I have seen only the first few pages, there are references to a description and figures of "*A. Titan*," obtained in 1855 by Captain Hygom in north latitude 31°, west longitude 76°. The latter specimen appears to be the same as that referred to in 1856 as *A. dux*, and the same that Harting‡ mentioned, under the name "*Architeuthis dux* Steenstrup," as collected at the same time and place, and of which he published an outline figure (see our Plate XII, fig. 4) of the lower jaw, copied from a drawing furnished to him by Steenstrup.

Harting states that the pen or 'gladius' of this specimen is 6 feet long. Many important parts of this specimen were secured, and I regret that I have been unable to see the figures and description of it, referred to by Harting as forming part of Professor Steenstrup's unpublished memoir. But to judge by the outline figure given by Harting, it is a species quite distinct from those described by me. The lower jaw

*Meddelelse om tvende Kiæmpestore Blæksprutter, opdrevne 1639 og 1790 ved Islands Kyst, og om nogle andre nordiske Dyr. Förhandlinger Skandinaviske Naturforskeres, v, pp. 950–957, 1847, Copenhagen, 1849.

Oplysninger om Atlanter colossale Blæksprutter, Förhandlinger, Skand. Naturf., 1856, vii, p. 182, Christiania, 1857.

†In a paper, of which I have seen some proof-sheets, given by him to Dr. Packard, entitled "Spolia Atlantica." This memoir has not been published. The plate (1) that I have seen is marked "Vid. Selsk. Skrifter, V. Række, naturv. og mathem. Afd. iv Bind;" and there are references to three other plates, illustrating "*A. Titan*," &c.

‡Description de quelques fragments de deux Céphalopodes gigantesques. Publiées par l'Académie Royale des Sciences à Amsterdam. 1860. 4to, with three plates. (Verh. K. Akad. Weten., ix, 1861.) The figures have been partly copied in Tryon's Manual of Conchology, i, plates 60 and 86.

resembles that of *A. Harveyi* more than *A. princeps*, and is a little larger than that of our No. 5. The beak is more rounded dorsally, less acute, and scarcely incurved; the notch is narrow, and the alar tooth is not prominent.

M. Paul Gervais, in the Journal de Zoologie, ix, p. 90, 1875, gives a short description of this species, based apparently on the proof-sheets and unpublished plates (not seen by me) of Steenstrup's article referred to above. He describes it as follows: A large species, of which a fragment of an arm preserved in the Museum of Copenhagan is nearly as large as the arm of a man. The sucker-bearing surface of the arm is extended bilaterally into a membrane exceeding, on each side, the arm itself. Diameter of the opening of the suckers 0.020^{m}; of the suckers themselves 0.030^{m}. Length of the dorsal bone (pen) 2^{m}; breadth [longueur, by error], measured in the middle of its length [longueur], 0.17^{m}. He refers to Steenstrup's Plates III and IV.

In a letter to the writer, dated September 4, 1875, Professor Steenstrup states that, in addition to the specimens above mentioned, there are, in the museum of the University of Copenhagen, two complete specimens of *Architeuthis*, preserved in alcohol. Both are of comparatively small size. One, from the northern coast of Iceland,* he refers to *A. monachus*. It has tentacular arms 10 feet long, and sessile arms 4 feet long. The other is a still smaller one, from the warmer parts of the Atlantic, possibly the young of *A. dux*.

It is evident, therefore, that at no distant day most of the remaining doubtful points in respect to the structure and relationship of the species of this genus can be cleared up by Professor Steenstrup, even if additional specimens should not be obtained.

The publication of Professor Steenstrup's detailed memoir upon this genus would give great pleasure and satisfaction to all students of this class of animals. His thorough knowledge of the group, and his numerous and important investigations of the Cephalopods, published during many years, will give special value to his conclusions.

Harting, in the important memoir referred to, describes specimens of two species, both of which are apparently distinct from all the Newfoundland specimens enumerated by me.

The first of these (his Plate I) is represented by the jaws and buccal mass, with the lingual dentition and some detached suckers, preserved in the museum of the University of Utrecht, but from an unknown locality. These parts are well figured and described, and were referred to *Architeuthis dux* by Harting. The form of the lower jaw (see Plate XII, fig. 1) is unlike that of *A. dux*, for the beak is very acute, the cutting edge is concave, the notch shallow and broad, and the alar tooth is somewhat prominent. The size is about the same as our No. 5. The suckers (Plate XII, fig. 2 *a*, 2 *b*) are from the sessile arms, and agree pretty nearly with those of *A. Harveyi*. The edge is strengthened by

*This one is referred to by Dr. Packard, Amer. Naturalist, vol. vii, p. 94, 1873.

an oblique, strongly denticulated ring, which, in all the suckers figured, including both larger and smaller ones from the short arms, has regular, acute, subequal denticles all around the circumference, in this respect agreeing with *A. Harveyi*. The internal diameter of the largest of these suckers is .75 of an inch; the external 1.05 inches. They were furnished with slender pedicels, attached obliquely on one side. The lingual teeth (see Plate XII, fig. 1*c*, copied from Harting) are in seven regular rows, and resemble closely those of *Loligo*. On that account mainly, in a former paper, I proposed to designate it by the name of *Loligo Hartingii*. But since that time I have been able to study the dentition of the species of *Architeuthis* and *Sthenoteuthis*, and now refer Harting's species to *Architeuthis*, without hesitation, although the dentition is poorly figured. Professor Steenstrup, in a letter to me subsequent to the publication of my former papers, also expressed the opinion that Harting's specimen belongs to *A. monachus*. If distinct, however, as is possible, it may be called *Architeuthis Hartingii*.

The other species described by Harting was from the Indian Ocean, and belongs to the genus *Enoploteuthis* (Plate XII, fig. 4, jaws).

In this genus there are large, sharp, curved claws (see Plate XV, figs. 5, *a*, *b*), both on the club of the tentacular arms and on the sessile arms, in place of the suckers of ordinary squids. The teeth of the odontophore, in Harting's species, are remarkably small and simple (see fig. 5, *c*, *d*, after Harting). As this species does not appear to have had a special name, I propose to call it *Enoploteuthis Hartingii*.

D'Orbigny* gave the name *Enoploteuthis Molinæ* to a large species, of which the body was estimated to be about 4 feet long, found floating and mutilated in the South Pacific, south latitude 30° 44′, west longitude 110° 33′, by Banks and Solander, in 1769, on Captain Cook's second voyage. Of this, fragments are preserved in the Museum of the College of Surgeons, London.†

A similar species, perhaps based on the same specimen, was recorded by Molina, from off the coast of Chili, as *Seppia unguiculata*.

Lieutenant Bouyer, of the French steamer "Alecton," encountered a huge Cephalopod, in November, 1860, between Madeira and Teneriffe. Its body was estimated to be between 15 and 18 feet in length. A long and laborious attempt was made to capture it, and a slip-noose was passed around the body, but on attempting to hoist it on board, the rope cut through the soft flesh and the tail alone was secured. A sketch of the animal was made by one of the officers.

The original account of this occurrence, given in the Comptes-Rendus of the French Academy of Science for 1861, is as follows:

M. Flourens read the following report made to the minister of the marine by M. Bouyer, lieutenant commanding the "Alecton."‡

* Histoire Nat. des Céphalopodes Acétabulifères, p. 339, 1845.

† See also Todd's Cyclopedia of Anatomy and Physiology, i, p. 529.

‡ Comptes-Rendus Acad. of Sciences, vol. liii, p. 1263. For the following translations I am indebted to Mr. Sanderson Smith.

"SAINTE-CROIX DE TÉNÉRIFFE,
"'*Alecton*,' *December* 2, 1861.

"Monsieur le MINISTRE: I have the honor to inform your excellency that I anchored at Ténériffe the 1st of December, at eight o'clock in the morning.

"From Cadiz to Ténériffe, that is to say, from the 27th of November to 1st of December, I have encountered the most favorable weather; thus, making use of my sails, setting the safety-valve at 0.30—in a word, economizing fuel as much as possible, I have been sometimes able to reduce the consumption to 6 tons a day, going to 7 or 8 knots, with a moderate breeze from the northeast.

"A singular incident has marked my voyage. On the 30th of November, 40 leagues from Ténériffe, at two o'clock in the afternoon, I encountered a monstrous animal which I recognized for the gigantic cuttle-fish [*poulpe géant*], the contested existence of which seems to have been consigned to the realm of fable.

"Finding myself in the presence of one of these strange beings that the ocean sometimes produces from its depths as if to offer defiance to science, I resolved to study nearer by, and try to gain possession of it.

"Unfortunately, a heavy swell, taking us on the side, caused the 'Alecton' to roll irregularly, and interfered with the evolutions, whilst the animal itself, though almost always at the surface of the water, moved itself with a kind of intelligence, and seemed to wish to avoid the vessel.

"After several encounters, which permitted only of its being struck by several balls, I succeeded in approaching near enough to place a harpoon in it, as well as to get a running noose around it. We were preparing to multiply the fastenings when a violent movement of the animal caused the harpoon to come out; the part of the tail where the cord was fastened broke off, and we brought on board only a fragment, weighing 20 kilograms [about 44 pounds].

"We had seen the monster near enough to make an exact painting of it. It is the giant squid [*encornet*], but the form of the tail seems to make of it an undescribed variety. It seemed to measure 15–18 feet to the head, shaped like a parrot's beak, and enveloped by 8 arms, from 5 to 6 feet long. Its appearance was frightful, its color a brick-red, and this half-formed being [*être ébauché*], this colossal and slimy embryo, has a repulsive and terrible appearance.

"Both officers and men begged me to have a boat lowered and to go and seize again upon the animal and bring it alongside. They would, perhaps, have succeeded, but I feared that in this hand to hand encounter the monster might throw his long arms, furnished with suckers, over the sides of the boat, upset it, and perhaps strangle some sailors with his formidable scourges, charged with electrical effluvia.

"I thought that I ought not to expose the lives of my men to satisfy a sentiment of curiosity, even though this curiosity had science for its basis, and, notwithstanding the fever of excitement which accompanies

such a chase, I was obliged to abandon the mutilated animal, which, by a sort of instinct, seemed to carefully avoid the vessel, dived, and passed from one side to another when we again approached it."

The following is a translation of a letter addressed to M. Moquin Tandon by M. Sabin Bertholet, consul of France, which was also read before the Academy. It contains some additional particulars:

"SAINTE CROIX DE TÉNÉRIFFE, *December 12th*, 1861.

"On the 2d of November last the steam dispatch-boat 'Alecton,' commanded by M. Bouyer, lieutenant commanding, anchored in our harbor on its way to Cayenne. This dispatch-boat had encountered in the sea, between Madeira and Ténériffe, a monstrous cuttle-fish [*Poulpe*], which was swimming at the surface of the water.

"This animal measured from 5 to 6 meters in length, without counting its eight formidable arms, covered with suckers, which crown its head. Its color was brick-red. Its eyes, not rising above the surface of the head, had a prodigious development and frightful fixity. Its mouth, shaped like a parrot's beak, might have measured [*offrir*] about half a meter. Its body, spindle-shaped, but very much swollen towards the center, presented an enormous mass of which the weight has been estimated at more than 2,000 kilograms [4,400 pounds]. Its fins, situated at the posterior extremity, were rounded into two fleshy lobes of very great size. It was on the 30th of November, about half-past twelve, that the crew of the 'Alecton' perceived this terrible Cephalopod swimming alongside. The commander immediately stopped the vessel, and notwithstanding the dimensions of the animal he maneuvered to obtain possession of it. A running noose was arranged in order to catch it, guns were loaded, and harpoons prepared in all haste. But at the first balls which were fired at it the monster dived, passing under the vessel, and speedily reappeared on the other side; again attacked with harpoons, and after having received several shots, it disappeared two or three times, each time showing itself some minutes afterwards at the surface of the water, agitating its long arms. But the vessel followed it continually, or slackened its speed according to the movements of the animal. This chase lasted more than three hours. The commander of the 'Alecton' desired, at any cost, to dispose of this enemy of a new kind; still, he did not dare to risk the lives of his sailors by lowering a boat, which this monster might upset by seizing it with a single one of his formidable arms. The harpoons, which were thrown at it, penetrated into the soft flesh and came out without success; several balls had traversed it uselessly. However, it received one which seemed to wound it grievously, for it immediately vomited a great quantity of foam and blood mixed, with glutinous substances which had a strong odor of musk. It was at this instant that they succeeded in seizing it with the running noose; but the rope slipped along the elastic body of the mollusk, and stopped only near the extremity where the

two fins originate. They tried to hoist it on board. Already the greater part of the body was out of water, when the enormous weight of this mass caused the running noose to penetrate the flesh and separated the posterior part from the rest of the animal. Then the monster, released from this noose, fell back into the sea and disappeared. They showed me, on board the 'Aleeton,' this posterior part. I send you a sufficiently exact drawing of this colossal poulpe, made on board by one of the officers of the 'Aleeton.*

"I ought to add I have myself questioned old fishermen of the Canaries, who have assured me that they have several times seen, in the open sea, great reddish calamaries, 2 meters or more long, which they did not dare to capture."

Messrs. Crosse and Fischer have, from the figure and this narrative of the officers,† proposed to establish for this specimen a species, which they named *Loligo Bouyeri*. The figure is imperfect, but evidently represents a ten-armed cuttle-fish, though only eight arms are shown, and the tail is represented as truncated.‡ In fact, these figures and the description are not sufficient to indicate specific or exact *generic* characters. The eight short arms, shown in the figure, are stout, tapered, and less than half the length of the head and body together. It was most probably a species of *Architeuthis*, to judge from the caudal fin, described as consisting of two lobes of small size. It may be designated provisionally as *Architeuthis Bouyeri*.

In a popular work entitled "Les Monstres Marins," by Armand Landrin, Paris, 1867, there is also a detailed account of this encounter, which, while agreeing in most points with those already quoted, contains some additional particulars. Although it is put in quotation-marks, and is stated to be by M. Bouyer himself, the original place of publication is not given, and I have not been able to ascertain its origin. In this account the eyes are said to have been "flat, glaucous, and as large as saucers [*assiettes*]." "The part of the tail that we had on board weighed 14 kilograms; it was of a soft substance, exhaling a strong odor of musk. The part which corresponds to the backbone [pen] began to attain a sort of relative hardness. It broke easily, with an alabaster-white fracture. The entire animal, according to my estimate, weighed two or three tons [4,000 to 6,000 *livres*]. It blowed [*soufflait*] energetically, but I did not observe that it ejected the black ish substance by means of which the small calamaries of Newfoundland destroy the transparency of the water in order to escape from their enemies. The sailors told me that they had seen to the south of Good Hope poulpes similar to this, although of less size."

The description in this work is accompanied by a cut representing

* This colored drawing was shown to the academy.

† Journal de Conchyliologie, 3d ser., vol. ii, p. 138, 1862. See, also, Tryon's Manua of Conchology, vol. i, p. 87, pl. 59, 1879 (figure copied from "The Universe").

‡ One of the published figures, as explained above, shows ten arms and all the other essential characters of *Architeuthis*.

the creature swimming just beneath the surface of the sea. This is unlike either of the other two illustrations that I have seen, but the origin of this figure is not given. In the popular work "The Ocean World," by Louis Figuier (London edition, 1869, p. 462), there is also an account of this encounter, which is for the most part a translation from the original accounts given above, accompanied by a figure which, as the author states, "is copied from M. Berthelot's colored representation of this scene." This is a very fair representation of a genuine *Architeuthis*, and is of especial interest, if we recollect that when this figure was made there was no figure extant, nor any authentic description of the form and structure of *Architeuthis*. The head is undoubtedly represented too large, but the form and proportion of the, body caudal fin, arms, and tentacles are very much like those of the Newfoundland examples.

Popular accounts of this, as well as of other large Cephalopods of earlier occurrence, are contained in many other general works besides those referred to above.*

In "Les Monstres Marins" (p. 44), referred to above, there is the following account, inclosed in quotation marks, but without any statement of the source from which it was taken:

"An American captain, whom I knew very well, in New York," says B. H. Révoil, "told me that in 1836, when he was in the neighborhood of Lucayes Islands, his ship had been attacked by a cuttle-fish, which, stretching out its gigantic arms, had reached and dragged into the sea two men of his crew. With a blow of his hatchet, the chief steersman cut off one of its arms. This monstrous appendage measured 3½ meters (11½ feet) in length, and its thickness was that of a man. I have seen this curious specimen of natural history in the museum of Mr. Barnum, in New York, where it is preserved, shriveled and folded on itself, in an enormous jar full of alcohol."

Some of our older readers may, perhaps, have seen such a specimen in Barnum's Museum, which, however, has not been regarded in this country as a very reliable source of scientific information on such subjects. Possibly this specimen, as well as the story, may have been an ingenious invention.

According to Jeffreys (British Conchology, vol. v, p. 124), a huge Cephalopod was stranded in 1860 or 1861, between Hillswick and Scalloway, on the west of Shetland. "From a communication received by Professor Allman it appears that the tentacles were 16 feet long, the pedal arms about half that length, and the mantle-sac 7 feet; the mantle was terminated by fins; one of the suckers examined by Professor Allman was ¾ inch in diameter."

Mr. Kent, in the articles† already referred to, mentions a sessile arm

* Among these popular works, of permanent value, containing such accounts should be cited "The World of the Sea," translated and edited by the Rev. H. Martyn Hart, London, Cassell, Petter & Galpin, from "Le Monde de la Mer," by M. Moquin Tandon.

† Proceedings Zoological Society of London for 1874, pp. 178 and 493.

of a giant Cephalopod which has been long preserved in the British Museum, but of which the origin is unknown. He states, in the first article, that it is just 9 feet long and 11 inches in circumference at the base, tapering off to a fine point. There are about 150 suckers in each of the two alternating rows, those at the base being .75 of an inch in diameter.

In his second article he refers this arm doubtfully to *Ommastrephes todarus*, and gives the following description:

"The length of this arm, from one extremity to the other, is just 9 feet; the circumference at the base 11 inches; and from this it gradually decreases, terminating in a fine point. The suckers are arranged in two rows throughout the extent of the arm, numbering, approximately, 150 to each row, or a total of 300 to the whole organ. Forty-three suckers only are stationed on each side in the first or proximal half of the arm; one hundred on each side occupy the whole length, with the exception of 14 inches, this smaller length including the remaining fifty on each side, which are very minute and crowded together. The comparative distances between the suckers throughout the whole length in each row are as follows: Between the first and second sucker, 1½ inches; half way up the arm, 1 inch; at three-quarters of the entire length, ½ inch; and within 6 inches of the distal extremity, ¼ inch. The relative diameters of the suckers at similar distances are: At the base, extreme outside measurement, ¾ inch; inside measurement of corneous ring, ½ inch; and, those suckers a little past the first few being the largest, half way down, ½ inch outside and ½ inch inside measurement; at three-quarters length, ¼ inch; and at 6 inches from the extreme point, ⅛ inch outside measurement, gradually diminishing from here to the size of a pin's head.

"The shape and structure of the suckers upon this British Museum specimen agree with those of *Ommastrephes todarus*, as given by D'Orbigny, corresponding also with those figured by Harting, referred by him to the same species, and anticipated by the same authority to be also identical with Professor Steenstrup's *Architeuthis dux*. More minutely they may be described as hemispherical in shape, the stalk or peduncle being attached laterally at the base of the hemisphere, the point of insertion of the same in the cup being marked by a conspicuous pit-like depression. The horny ring is obliquely set, and much deeper at the side opposite the insertion of the stalk; the inner margin is serrated; and in most examples the serratures bordering the deeper side are considerably larger than in the other portions of the circumference; in some instances the serratures, except at the particular point mentioned, are altogether aborted, having the inner margin of the ring quite smooth; in other examples, and more especially among the larger suckers, the teeth or serratures are equal or subequal. The average number of the teeth of the largest rings is twenty."

Mr. Kent, unfortunately, does not state to which pair this arm

belongs. But from his description of the two forms of suckers, it is probably one of the lateral arms, if it is in this respect like our young *A. Harveyi* (No. 24). It evidently belongs to an *Architeuthis*, and is very near to our *A. princeps*.

In the Zoologist, London, 2d series, No. 118, p. 4526, July, 1875, there is an article entitled "Notice of a gigantic Cephalopod (*Dinoteuthis proboscideus*), which was stranded at Dingle, in Kerry, two hundred years ago. By A. G. More, F. L. S." The article is chiefly a reprint of the rude but interesting popular accounts written at the time of the capture, and upon these Mr. More proposed to found a new genus and species. The character which he mainly relied upon, as of generic value, is the power of projecting the beak in the form of a proboscis. But this is habitually done by the various common species of *Ommastrephes*, *Loligo*, &c., and perhaps by all ten-armed Cephalopods. There is not sufficient evidence, from the published accounts, that this specimen differed in any way from the *Architeuthis monachus*. It was described as 19 feet in total length; the long arms having been mutilated, the part remaining was 11 feet long, and as thick as a man's arm; the short arms varied from 6 to 8 feet in length, and were as thick as a man's leg, and had two rows of large serrated suckers; the proboscis (buccal mass with beak) was the size of a man's fist; the beak was "somewhat like to an Eagle's Bill, but broader." The whole animal was said to have been as large as a large horse. The length of the head and body together was 8 feet.

Mr. More has kindly sent me a tracing from the original figure. This shows a broad, oval, flat body, and a small caudal fin. The body or mantle had evidently been split open and spread out flat.

This fact is also evident from the original descriptions, reprinted by Mr. More, in which the sides of the mantle are described as follows: "Over this Monster's back was a mantle of a bright Red Color, with a fringe round it; it hung down on both sides like a Carpet on a table, falling back on each side, and faced with white." The liver, according to the descriptions, had been removed: "When it was dead and opened the liver wayed 30 pound." The proboscis had also been removed before it was exhibited, and it is therefore very probable that the figure and descriptions represent it as more extended than was natural.

The measurements given indicate a specimen smaller than several of the American examples, and but little if any larger than our No. 5, from Logie Bay.

The more important of these ancient letters are here reproduced:

"*Letter No. 2, from Thomas Hooke (Dublin) to Mr. John Wickins (London) December 23, 1673.*

"LOVING FRIEND: I send you this onely pursuant to my former of the Fish, which I now confirm to be as I gave you the first Account with this addition of certainty, that knowing the man by name James Steward, and hearing two or three nights since of his being at a Printers

neer our house to get the Lord Lieutenants Order Printed, which he gave him for exposing what he hath of the fish to view, I sent, desiring to speak with him, and he came, having then the Picture with him of the Fish, and he gave me himself the full account of it, viz.

"That in the month of October last, I think about the 15th day he was alone riding by the sea-side, at Dingle-I-cosh and saw a great thing in the Sea, which drew his eye towards it, and it came just to him; when he discerned the horns it began to look frightfully, he said he was sometimes afraid to look on it, and when he durst look on it, it was the most splendid sight that ever he saw; The Horns were so bespangled with those Crowns, as he calls them; they shewed he saith like Pearls or precious Stones; the Horns it could move and weild about the Head as a Snail doth, all the ten; the two long ones it mostly bore forwards, the other eight mov'd too and fro every way; When it came to shore its fore parts rested on the shore, and there lay; He got help after awhile, and when he saw it stirred not to fright them, he got ropes and put them about the hinder parts, and began to draw it on shore, and saw it stir'd not to hurt them, they grew bold, and went to pull with their hands on the Horns, but these Crowns so bit them, that they were forced to quit their hold; the crowns had teeth under every one of them, and had a power to fasten on anything that touched them; they moved the Horns with handspikes, and so being evening they left it on the shore, and came in the morning and found it dead. The two long Horns are about one 11 foot, the other 9; the other 8 Horns, about 6 and 8 foot long a peice, and as thick as a man's arm every one of them. He hath brought up to Dublin but two short Horns of the Crowned ones, and the little Head, being not able to bring the rest the way is so long.

"The certainty is attested by many at the place, and is no doubt a very certain truth, the mantle was all red on the out-side, which for the colour sake he kept a peice of it, it was five inches thick, and white under; when they cut the Fish it had not a drop of blood, nor scale, nor fin, my man took a draught of the Picture which I have here enclosed, he said it was as big as any horse as ever he saw, it had no leggs.

"Your loving friend,

"THOMAS HOOKE."

"*Letter No.* 3, *from Thomas Clear to his son, dated Drangon, neer Clonmell, December* 19, 1673.

"DEAR SON: I did the last week write to you, which I hope you have received, to which I refer you. This inclosed paper is a form of a strange and monstrous Fish, that was cast on shore in the County of Kerry in Ireland, about a month since by a storm, you need not doubt the truth of it, for I have myself seen part of it, and have one of the Crowns by me to produce, I refer you to the paper for a relation of it; remember your duty both to God and man; be carefull in both, and the

Lord direct you with all our Dear loves to you and all friends, concludes him that is your very affectionate loving Father.

"THOMAS CLEAR."

"*The Monster Described.*

"This Monster was taken at Dingle-I-cosh in the county of Kerry, being driven up by a great storm in the Month of October last 1673; having two heads, one great head (out of which sprung a little head two foot, or a yard from the great head) with two great eyes, each as big as a pewter dish, the length of it being about nineteen foot, bigger in the body than any horse, of the shape represented by this figure, having upon the great head ten horns, some of six some of eight or ten, one of eleven foot long, the biggest horns as big as a man's Leg, the least as his wrist, which horns it threw from it on both sides; And to it again to defend it self having two of the ten horns plain, and smooth that were the biggest and middle horns, the other eight had one hundred Crowns a peece, placed by two and two on each of them, in all 800 crowns, each Crown having teeth, that tore any thing that touched them, by shutting together the sharp teeth, being like the wheels of a watch, The Crowns were as big as a man's thumb or something bigger, that a man might put his finger in the hollow part of them, and had in them something like a pearl or eye in the middle; over this Monster's back was a mantle of a bright Red Colour, with a fringe round it, it hung down on both sides like a Carpet on a table, falling back on each side, and faced with white; the crowns and mantle were glorious to behold: This monster had not one bone about him, nor fins nor scales, or feet, but had a smooth skin like a man's belly. It swoom by the lappits of the mantle; The little head it could dart forth a yard from the great, and draw it in again at plesure, being like a hawk's beak and having in the little head two tongues by which it is thought it received all its nourishment; when it was dead and opened the liver wayed 30 pounds. The man that took it came to Clonmel the 4th of this instant December, with two of the horns in a long box with the little head, and the figure of the fish drawn on a painted-cloth, which was the full proportion of it, and he went up to Dublin, with an intent to shew it to the Lord Licutenant."

"*Letter No.* 4, *manuscript.*

"In a Letter from a very Sober person in Dublin dated 27th of December 1673.

"Yesterday I went to See part of the Sea Monster, which was taken at Dingle, viz. the two Bigg Hornes and the little head, the Hornes are neare foure foot long, and about six inches thick towards the Root, and full of little Coronetts about the Compass of a groat, and teeth in every one of them, they were fixt to the Horne, with a string like a Veine, by which I conceive they received Nourishment, rather then that the nour-

ishment should be conveyed through them downe the Hornes to the Beast. The head was not soe bigg as my fist, the mouth and two hard shells upon it very black and shap'd somewhat like to an Eagles Bill, but broader; In the mouth there was two tongues, and (as the Man declared that tooke this monster) the Beast had naturall power to draw this head in or putt it out of the Body as necessity required."

In the Zoologist, June, 1875, p. 4502, and August, p. 4569, and in the August number of the Annals and Magazine of Natural History, vol. xvi, p. 123, Mr. More also gave an account of the capture, and briefly described the beak, odontophore, and portions of the tentacles and arms of another specimen, taken off Boffin Island, on the west coast of Ireland, April, 1875. The tentacular arms are said to have been 30 feet long; the expanded portion, 2 feet 9 inches; the large central suckers, nearly 1 inch in diameter; those of the outer rows, .5 of an inch; one short arm is said to have been 8 feet long and 15 inches in circumference at the base when fresh. It had small suckers without teeth on the horny rings, on the 'wrist' of the 'club' and scattered along the tentacular arms, as do our specimens. The rounded tubercles that always accompany these smooth-rimmed suckers are not mentioned, but doubtless they were also present. The beak was 5.25 inches long and 3.5 inches broad, dark reddish brown, "with a large tooth in both margins of the inner mandible and a much smaller notch on each side of the outer mandible."

Mr. More believed this to be distinct from the Newfoundland species, and referred it to *A. dux*, but his description agrees closely with the corresponding parts of *A. Harveyi* (No. 5) described by me, except in the relatively somewhat greater size of the sessile arms at base. In this respect, however, it is equaled or surpassed by our No. 14, and by others of the Newfoundland examples. This may also be only a peculiarity of the female. The measurements indicate a specimen intermediate in size between our Nos. 5 and 14, but the description is not sufficient to indicate with certainty to which of our species it was nearest related. A more detailed description, with figures of the suckers and odontophore, would probably settle this point. Mr. More supposed that the lateral suckers of the tentacular club were larger in his example than in *A. Harveyi*, but that is not the case.

Prof. G. O. Sars, in his recent work (Mollusca Reg. Arct. Norvegiæ, p. 377), also mentions a specimen of *Architeuthis* (12 feet long) cast ashore on the Norwegian coast, at Foldenfjord, in 1874. He refers it doubtfully to "*A dux* Steenstrup" (from the Kattegat), by which we should understand *A. monachus*, without doubt.

In "Nature," vol. xxii, No. 25, October 21, 1880, p. 585, under the caption "An Octopus," there is an account of the stranding of a large Cephalopod, early in October, at Kilkee, County Clare, Ireland, from a letter of the Rev. R. J. Gabbett. The description, though very imperfect, is sufficient to show that it was not an *Octopus*, but probably an

Architeuthis, which had lost its tentacular arms, as is often the case with stranded specimens. The length of the head is given as about 3 feet, and its diameter is given as 1½ inches—probably a mistake for 1½ feet. The more important points are as follows: "Its arms had been partially broken; there were eight of them, each as thick as a strong man's upper arm, and beneath each were two rows of suckers like cupping-glasses, more than a shilling size in circuit. When perfect, each of these arms must have been from 12 to 15 feet long, and from the point of one arm to that of its opposite was a length of nearly 30 feet. The animal's length, from the insertion of its suckers to the end of its body, must have been nearly 20 feet—perhaps more. Its mouth, like a parrot's beak, was as large as two joined hands of a large man, with the fingers outstretched. It weighed about 4 cwt."

Examples from the Indian Ocean and New Zealand.

In the Journal de Zoologie, vol. iv, No. 2, p. 88, 1875, M. Paul Gervais has given a partial summary of the gigantic Cephalopods previously known, and has mentioned an additional species (*Architeuthis Mouchezi* Vélain), of which portions were brought to Paris by M. Vélain, from the Island of Saint Paul, Indian Ocean, where it was cast ashore in November. He also quotes the brief notice of the animal by M. Vélain (in Comptes-Rendus, t. lxxx, p. 1002, Séance du Avril 19, 1875). It is stated that this example belongs to the same group with *Ommastrephes*. A description and a rude figure of it, made from a photograph taken in the position in which it lay upon the shore, has also been published by M. Vélain in the Arch. de Zool. Exper., vol. vi, p. 83, 1877. The figure has been copied in Tryon's Manual of Conchology, vol. i, pl. 82. According to this figure, the tentacular arms were very long and the short arms were truncated, probably owing to mutilation. One of the tentacular arms was saved, and, with the beak, was preserved in Paris. The caudal fin was narrow and lanceolate, adhering to the sides of the body by its entire length. In the latter feature this is very different from any of the northern species.

In the Archives de Zool. Experimentale, vol. vi, 1877, M. Vélain has proposed a new genus (*Mouchezia*) for this specimen. The peculiarity of the pen appears to be the only character of any special importance referred to by him.

Mr. T. W. Kirk, in the Transactions of the Wellington Philosophical Society, for October, 1879, p. 310, has published accounts of the occurrence of five specimens of "giant cuttle-fish" on the coast of New Zealand:

No. 1. The first of these was cast ashore at Waimarama, east coast, in September, 1870. Of this the beak was preserved and sent to Mr. Kirk by Mr. Meinertzhagen, whose account of the occurrence, with a rather crude description and some measurements made by an eye-witness, Mr. Kirk has printed. He gives no description of the beak, un-

fortunately. The dimensions given are as follows: Length from tip of tail to root of arms, 10 feet 5 inches; circumference, 6 feet; length of arms, 5 feet 6 inches. "The beast had eight tentacles, as thick as a man's leg at the root; horrid suckers on the inside of them, from the size of an ounce bullet to that of a pea at the tip; two horrid goggle eyes; and a powerful beak between the roots of the arms. His head appeared to slip in and out of a sheath. Altogether he was a most repulsive looking brute."

It is probable that this specimen had lost its two tentacular arms before death, and that it was actually of the same species as the other specimens recorded by Mr. Kirk. Mr. Kirk, however, seems to think that the above description refers to an Octopod.

No. 2. "The beak of number 2 was deposited in the Colonial Museum by Mr. A. Hamilton. The animal was captured at Cape Campbell by Mr. C. H. Robson, a member of this society, who very kindly furnished me with the following information. Writing on the 19th June, 1879, he says:

"'In reply to yours of the 12th about the cuttle-fish, I may state that while stationed at Cape Campbell I found several specimens of large size, all, however, more or less mutilated, except one, the beak of which I gave to Mr. Hamilton. It was alive and quite perfect, the body being 7 feet long, eight sessile arms 8 feet long, and two tentacular arms 12 feet. I am, however, only writing from memory. Mr. Hamilton has the exact measurements, and I remember distinctly that the total length was close on 20 feet.'

"I am sorry to say that Mr. Hamilton has mislaid the notes and measurements, but those given above cannot be far out."

No. 3. The third specimen was examined and measured by Mr. Kirk, personally, where it lay on the beach. He also made a drawing of it, but it has not yet been published to my knowledge. It was found on the beach at Lyall Bay, May 23, 1879, by three boys. Mr. Kirk states that it had been somewhat mutilated by the natives before he saw it, and the pen or bone had been cut across; but he preserved all the pieces of the pen, the beak, tongue, and some of the suckers. Most of the suckers had been torn off.

"The length of body from tip of tail to anterior margin of the mantle was 9 feet 2 inches, and 7 feet 3 inches in circumference; the head from anterior margin of mantle to roots of arms, 1 foot 11 inches; making the total length of the body 11 feet 1 inch. The head measured 4 feet in circumference. The sessile arms measured 4 feet 3 inches in length, and 11 inches in circumference. Each of these arms bore thirty-six suckers, arranged in two equal rows (as shown by the scars), and measuring from $\frac{13}{16}$ to $\frac{1}{4}$ of an inch in diameter. Every sucker was strengthened by a bony ring armed with from forty to sixty sharp incurved teeth. The tentacular arms had been torn off at the length of 6 feet 2 inches, which was probably less than half their original length.

"The fins were posterior, and were mere lateral expansions of the mantle. They did not extend over the back, as in the case with *Onychoteuthis*, &c. Each measured 24 inches in length and 13 inches in width.

"The cuttle-bone, when first extracted, measured 6 feet 3 inches in length and 11 inches in width, but has since shrunk considerably. It was broadly lanceolate, with a hollow conical apex $1\frac{1}{8}$ inches deep."

No. 4. "Another specimen, measuring 8 feet in length, was lately caught by a fishing party near the Boulder Bank, at Nelson, concerning which I have only seen a newspaper cutting, and have not been able to obtain particulars."

No. 5. "A fifth was found by Mr. Moore, near Flat Point, east coast. A description was sent to Mr. Beetham, M. H. R., who, I believe, intends communicating it to this society."

From the above descriptions it is not possible to decide with certainty whether these specimens belong to the *Architeuthis*-group or whether they are more nearly allied to the *Onychoteuthis*-group, like *Moroteuthis*, for the armature of the tentacular arms is not known. The broad-lanceolate form of the pen, with a small conical hood at the end, would seem to indicate affinities with *Architeuthis*, and the presence of true suckers on the sessile arms, and small size of the fins, are favorable for that view. Altogether, the descriptions indicate that this New Zealand species is related to, and perhaps identical with, the one discovered at the Island of Saint Paul, and first named by M. Vélain *Architeuthis Mouchezi*. It is to be hoped that Mr. Kirk will soon give detailed descriptions and figures of the portions in his possession.

C.—*Examples from the North Pacific.*

The following species, although the specimens when found had lost some of their most characteristic parts, appears to be nearly related to *Onychoteuthis*, a genus having sharp claws instead of suckers on the 'club' of the tentacular arms, and a cluster of small tubercles and smooth suckers on its 'wrist,' to unite the arms together. It probably is nearly related to the group *Lestoteuthis*, characterized below.

Moroteuthis robusta (Dall, sp.) Verrill, 1881.

Ommastrephes robustus (Dall, MSS.) Verrill, Amer. Journ. Sci., vol. xii, p. 236, 1876.

Onychoteuthis (*Lestoteuthis*) *robusta* Verrill, Trans. Conn. Acad., vol. v, pp. 195, 246, 252, pls. 23, 24, 1880.

Plate XIII. Plate XIV.

This large and very interesting species* was discovered by Mr. W. H. Dall, near Iliuliuk, Unalashka Island, off the coast of Alaska.† He

* This is the species referred to as perhaps *Onychoteuthis Lergi* by Mr. Dall in his note upon large Cephalopods, in the American Naturalist, vol. vii, p. 484, 1873.

† The first specimen was found by Mr. M. W. Harrington, of Mr. Dall's party, on the west shore of Amaknak Island, Captain's Harbor, Unalashka, April 26.

found three specimens thrown upon the beach, April 26 and May 8, 1872. He made descriptions, measurements, and some very valuable drawings of them, while fresh. The specimens had all been more or less mutilated by the ravens before they were discovered. He preserved the pharynx, beak, and odontophore of No. 1, part of the 'bone,' a piece of the caudal fin, and the basal part of one of the ventral arms, with five of the suckers adhering, from one of the other specimens (No. 2), and has generously placed them in my hands for examination, together with his drawings, measurements, and notes.

The parts remaining of the largest specimen (No. 3) when found had a total length of 427^{cm} (14 feet), but the ends of the tentacular arms had been destroyed; length from tail to base of tentacular arms, 559^{cm} (8 feet, 6 inches); to front edge of mantle, 232.4^{cm} (7 feet, 7½ inches); width across fins, 107^{cm} (42 inches); diameter of body, 45.7^{cm} (18 inches); slender basal portion remaining of tentacular arms, 155^{cm} (61 inches); their diameter, 6.3^{cm} (2.5 inches); short arms (ends gone), 76^{cm} to 102 ^{cm} (30 to 40 inches); length of pen, 226^{cm} (7 feet, 5 inches).

According to Mr. Dall's note the color was reddish, in fine red dots on a whitish ground, with a darker stripe on the outer median line of the arms. The eyes were bluish black, furnished with lids, and with a small sinus in front; diameter of the opening, 2.5^{cm} (1 inch).

The mandibles retracted into a short, yellow, puckered muzzle, which was included in a longer, plain, proboscis-like tube, extending an inch or two beyond. Siphon, short and thick.* Region of the eye somewhat raised. The nuchal collar is well marked, and slightly above it, on each side, is a raised epidermal ridge, from which three wavy raised crests or frills, attached at their inner edge, pass obliquely backward, on each side. No cranial cartilage was observed. Mantle firm and dense. The neck has one median dorsal and two ventral facets, long, oval-shaped, with a median depressed line, but otherwise smooth and white; the dorsal moves on a smooth part of the inside of the mantle; the ventrals move on similar raised facets of the mantle beneath. The caudal fin was rather broad, lanceolate or spear-shaped, acute at tip. Gills yellowish olive, with obliquely transverse laminæ. Gizzard yellowish, the muscles laid like a coil of spun-yarn, in layers transverse to one another.

The pen (Plate XIII, figs. 4, 5) was gone from the first specimen (No. 1) and broken in the others. It was found unattached in the dorsal cavity. It had a thickened median rib, but becomes very thin at the sides, and is divided by sharp, stiff ribs or folds into three longitudinal areas on each side (Plate XIII, fig. 6). The posterior end is one-sided, funnel-shaped close to the tip, which is inserted into a long, round, thick, firm, cartilaginous cone, which tapers to a point posteri-

* No valve is shown in Mr. Dall's sketches.

orly. The portion of the pen (of No. 2) preserved* and forwarded to me includes all the cone and a part of the posterior end of the quill-portion, attached within the concavity of the cone (Plate XIV, fig. 7). The anterior end of the cone is concave and very obliquely terminated, the dorsal side extending forward some distance along the dorsal side of the quill. The whole length of the preserved cone (doubtless much shrunken by the alcohol) is 44.5^{cm} (17.5 inches); of the oblique anterior termination 15.25^{cm} (6 inches); greatest diameter 4^{cm} (1.6 inches). The cone is nearly round, firm, translucent, brownish or deep amber-color, and composed of numerous distinct concentric layers. The concavity of the anterior end firmly embraces the remnant of the funnel of the quill, which has numerous small costæ converging to the apex; two of the dorsal costæ are much stronger than the rest, forming a strong ridge each side of the smaller median costa, which lies in a deep median depression or furrow.

The tentacular arms had lost their clubs; but the part remaining was cylindrical, 2.5 inches in diameter. The other arms were somewhat thicker. The few suckers remaining on them were attached by slender pedicels, and arranged in two alternating rows; they were furnished with horny rims having the edge entire, except where irregularly broken away; those of the distal part of the arms were gone.

The portion of the arm of the second specimen preserved in alcohol and sent to me came from the base of the left ventral arm. It is 65^{mm} in length; diameter from inner to outer surface, not including marginal membrane, 45^{mm}; including membrane, 64^{mm}. It is well rounded on the inner face, but more flattened on the upper side, while the outer surface is broadly rounded; the outer angle has a strong, thick marginal membrane, 19^{mm} wide (see section of this arm, Plate XIV, fig. 8, *c*). The sucker-bearing surface is broad, with a slight marginal membrane along each margin (*b*, *b*^{1}), rising into broad, flat, somewhat thickened, blunt lobes alternating with the suckers. Two alternating rows of firm, smooth, rather irregular-shaped tubercles run along the median region, between the rows of suckers, with which they alternate, on each side.

This segment of the arm still bears five suckers, which appear to represent the first, second, and fourth pairs, though there may possibly have been others before the first of these. They are all similar, rather small in proportion to the arm, round, but little oblique, decidedly convex beneath, and with a rather long, slender pedicel (fig. 8, *a*). The horny marginal rings are dark brown, yellowish at the thin edge, which is entire and nearly smooth, except where broken. The largest of these remaining suckers are 8.5^{mm} in diameter outside; aperture, 5^{mm}; height of cup, 7^{mm}; length of pedicel, 3^{mm}.

*Mr. Dall states that he attempted to dry the rest of this pen, and that of No. 3, but they turned brown, and then black, effloresced, and decomposed. He also states that the pen, when fresh, was translucent whitish, and that it changed to brownish yellow in the alcohol.

The exposed parts of the jaws are black and polished; their internal laminæ are reddish brown, becoming translucent yellowish toward the margins.

The upper mandible (Plate XIV, fig. 5) has an elongated, tapered, considerably incurved, and sharp rostrum; the notch is rather narrow and deep, and a well-developed, triangular, lateral groove runs down from the notch for some distance, its upper border being in line with the cutting edge of the rostrum. The anterior edge of the alæ, so far as normally exposed, is nearly straight, but slightly undulated.

The lower mandible (Plate XIV, fig. 6) has the cutting edges of the rostrum slightly concave, with a slight notch close to the tip, which is small and incurved; the notch at the base is broad and shallow, bordered externally by a slight, angulated ridge; the exposed anterior edges of the alæ have each two slight lobes, but are otherwise nearly straight; the alæ are broader toward the inner end, which is obtusely rounded.

The lower mandible now measures, from the tip of the rostrum to the posterior dorsal border of the mentum, 13^{mm}; tip to the extreme posterior end of the gular lamina, 50^{mm}; to the dorsal angle of the same, 33^{mm}; tip to the inner end of the alæ, 46^{mm}; to the bottom of the notch, 13^{mm}; breadth of alæ, 24^{mm}; transverse breadth at notches, 12^{mm}.

The upper mandible, from the tip of the beak to the end of the palatine lamina, is 71^{mm} long; from tip of beak to end of frontal lamina, 53^{mm}; to bottom of notch, 11^{mm}; length of exposed (dark) portion of anterior edge of alæ, 14^{mm}.

The odontophore (Plate XIV, figs. 1–4) has a very broad, thin, marginal membrane, yellowish white in color, becoming brown and thickened toward the dentigerous portion, where there is a row of very small, thin plates, bordering the outer row of teeth; the ventral portion of the dentigerous band is dark brown, regularly convex, and narrowed gradually to the obtuse end; the dorsal portion is considerably longer, abruptly bent backward, with the borders incurved, gradually decreasing to the posterior end; on this part the teeth become much smaller and paler.

The outer lateral teeth, on the anterior portion, are long, slender, sharp, and strongly curved; the median ones are much shorter, with a sharp, strongly curved central point, and a very small, almost rudimentary denticle on each side; the inner laterals are a little longer than the median, with a stout incurved point; on the outer side of its base there is a small denticle; the teeth of the two outer rows, on each side, are simple.

Length of odontophore, from anterior bend to posterior tip of dorsal end, 22^{mm}; to tip of ventral end, 14^{mm}; breadth of lateral membrane, in middle, 11^{mm}; of dentigerous belt, anteriorly, 3^{mm}.

The following measurements were made by Mr. Dall from the fresh specimens:

Table of measurements (in inches).

	No. 1.	No. 2.	No. 3.
Total length (to mutilated ends of tentacles)	80 +	110 +	167 +
Base of arms to tip of tail (head and body)	51	67	102
Base of arms to edge of mantle (head)	5	6	10.5
Edge of mantle to tip of tail (body)	46	61	91.5
Length of tail-fins (insertion to tip)	.....	33.75	48
Breadth of tail-fins	13.5 +	25.5	42
Length of 'pen'	.....	60	89
Breadth of pen, in middle	.....	.....	12.25
Length of tentacular arms (ends gone)	30 +	43 +	61 +
Length of longest sessile arms (ends gone)	30 +	23.5 +	40 +
Diameter of body	7.5	.....	18
Breadth between insertions of fins	.....	3.5	5
Diameter of eye	.....	1	1.25

The generic affinities of this species must be regarded as still somewhat doubtful, owing to the absence of the tentacular clubs, and most of the suckers of the sessile arms. The characters of the 'pen;' of the dentition, especially of the median teeth; of the nuchal frills; of the siphon; and of the cartilaginous facets, constituting the mantle fastenings, all indicate that it belongs in the family *Teuthidæ*, near *Onychoteuthis*. But in this family there is a great diversity as to the arrangement of the hooks and suckers constituting the armature of the arms. Some of these combinations are as follows:

TEUTHIDÆ.

Sessile arms with suckers only.

Onychia.—Tentacular club with two central rows of hooks, rows of small suckers along each margin, and a cluster of suckers and tubercles on the 'wrist.' Sessile arms with smooth suckers. (*Teleoteuthis* V.)

Onychoteuthis (typical).—Tentacular club with two rows of hooks, with an apical cluster of suckers, and with a cluster of suckers and tubercles on the wrist. (Plate XV, figs. 6, *a–c*.) Sessile arms with suckers in two rows.

Ancistroteuthis (typical).—Two central rows of hooks, with proximal and apical suckers on the club, as in the last. Pen narrow, widest anteriorly, with a long, terminal, hollow cone.

Gonatus.—Tentacular club with one or two central median hooks, and with numerous, multiserial, small suckers, distally and laterally. Sessile arms with four rows of suckers, those of the two central rows larger, all serrate.

Sessile arms with both suckers and hooks.

Abralia.—Tentacular club with two rows of alternating hooks and suckers in the middle, and with a cluster of suckers on the wrist and two rows at the tip. Sessile arms with hooks on the basal portion, and two rows of small suckers toward the tips. Pen dilated in the middle, hooded at the tip. Buccal membrane with suckers.

Lestotcuthis (gen. nov.).—Tentacular club with numerous suckers, and few large central hooks. Sessile arms dissimilar; lower ones with four rows of suckers; upper, with two central rows of hooks, alternating with marginal suckers on each side. Pen narrow, with a short, hollow, terminal cone. (Type, *L. Kamtschatica* Middendorff, sp.)

Sessile arms with hooks only.

Verania.—Tentacular club with hooks; sessile arms with hooks in two rows. Fins large and broad. Pen lanceolate.

Acanthoteuthis.—Tentacular and sessile arms with hooks. (Fossil.)

Ancistrochirus.—Tentacular and sessile arms with hooks in two rows. Pen lanceolate. Fins extending forward to edge of mantle.

Enoploteuthis (typical).—Tentacular club with two rows of hooks, and with a cluster of small connective suckers and tubercles on the wrist. Sessile arms all with hooks, in two rows, extending to the tips. Fins short. Pen lanceolate.

The position of *Moroteuthis* among the genera enumerated above must remain uncertain, for the present, because the armature of the tentacular club is unknown. But as it has smooth-ringed suckers on the ventral arms, at least at the base, it is probable that the genus is more nearly allied to the genera in the first group. But it differs very decidedly from all those named, in the form of the pen, and in having a long, solid cartilaginous cone, shaped like a large *Belemnites*, appended to its posterior end. In respect to this feature of the pen, this genus differs from all existing genera, and seems to have affinities with some of the mesozoic fossil genera.

In *Onychoteuthis* and *Teleoteuthis** the pen has a more or less lanceolate form, with a small posterior hood or hollow cone, without a solid appendix. *Gonatus* and *Lestoteuthis* not only differ from *Moroteuthis* in the pen, but have four rows of serrated suckers on the ventral arms.

The genus *Ancistroteuthis* (type *A. Lichtensteinii*) agrees somewhat better in the form of the pen, which is widest near the anterior end, from whence it tapers back to a long and oblique, compressed, posterior, hollow cone, but without a solid appendix at the end. It has numerous longitudinal nuchal crests, like *Onychoteuthis.*

It is not improbable that it may become necessary to establish a distinct family for *Moroteuthis*, when its armature becomes known. In that case the family should be called *Moroteuthidæ.*

LESTOTEUTHIS Verrill, 1880.

The characters of *Lestoteuthis Kamtschatica*, which I proposed to take as the type of this generic group, are not yet fully known. The peculiari-

* This name is proposed as a substitute for *Onychia* Lesueur, 1821 (*non* Hubner, 1816). The type-species is *T. carribæa* (Les., sp.). *T. platyptera* D'Orb. and *T. Krohnii* Verany appear to be additional species.

ties in the armature, both of the sessile and tentacular arms, as given above (p. 70), are quite sufficient, however, to warrant its separation from all the other genera. Its pen, as figured, also differs from all others hitherto described. It is narrowest anteriorly, gradually and slightly expanding backward to the one-sided, conical hood or cone, which is not inserted into a solid terminal cone, as in *Moroteuthis robusta*, and the blade is relatively larger. The caudal fin is large, rhomboidal, and acute posteriorly, as in the latter. The tentacular club bears two large, abruptly curved, claw-like hooks in the middle, with numerous small suckers around them and on the proximal part. The length of the head and body of the original example was about 28^{cm} (11 inches).

This genus is, in the character of its armature, very much like *Gonatus* Sars; the structure of its pen appears to be similar.

Mr. Dall has described a small species (probably young) from the coast of California, which may possibly belong to the same group. He referred it doubtfully to *Onychoteuthis* (*O. lobipennis* Dall).

A large Cephalopod, referred doubtfully to *Ommastrephes*, has been recorded from Japan and described by Dr. F. Hilgendorf.* It was taken on the east coast of Japan, north latitude 35° to 36°. It had been split open, salted, and partly dried, and the viscera had been removed. The ends or clubs of the tentacles were also gone. In this condition it was on exhibition in Yeddo. The following are the measurements given: Tip of tail to front edge of mantle, 186^{cm} (6 feet, 1 inch); mantle to mouth, about 41^{cm} (1 foot, 5 inches); longer sessile arms, 197^{cm} (6.5 feet); from tip of tail to tip of sessile arms, 414^{cm}; total expanse across outstretched tentacles, 600^{cm}; circumference of mantle (breadth as cut open), 130^{cm}; length of caudal fin, 60^{cm}; breadth of caudal fin in middle, 45^{cm}; breadth of forward end of caudal fin, 28^{cm}; diameter of posterior tip, 1^{cm}; tongue of funnel, 10^{cm} broad, 6^{cm} long; eye-opening, which was oblong-oval, without an obvious sinus, 19^{cm}; distance between eyes, 26^{cm}; diameter of oval skin of lip, 12^{cm} by 8^{cm}; breadth of sessile arms, 11^{cm}; of tentacles, 2^{cm} to 3^{cm}; diameter of horny rings of suckers on base, 1.5^{cm}; height, 0.7^{mm}; number of denticles, 37.

The great size, and especially the length, of the caudal fin in proportion to that of the mantle ($\frac{1}{3}$) render it probable that this was not a species of *Architeuthis*. The form of the fin, its length exceeding its breadth, is unlike the usual proportions in *Ommastrephes* and *Sthenoteuthis*. It is more probable that this specimen belonged to *Moroteuthis robusta*, or to some related form not yet characterized.

D.—*Note on large species of Octopus.*

Although this article relates specially to the gigantic species of ten-armed Cephalopods, it may not be amiss to add a few lines in respect to species of *Octopus* that attain large dimensions. It is certain, however,

*Mittheilungen der deutschen Gesellschaft für Natur und Völkerkunde Ostasiens. Herausgegeben von dem Vorstande, 1st Heft, p. 21, May, 1873, Yokohama, Japan. See also American Journal of Science, vi, p. 237, September, 1873.

that none of the latter that have hitherto been examined by naturalists reach dimensions to be compared with those of the species of *Architeuthis*, *Moroteuthis robusta*, and their allies.

The common *Octopus* of the west coast of North America (*O. punctatus* Gabb) is one of the largest of its tribe hitherto studied. According to Mr. W. H. Dall,* it occurs abundantly at Sitka, and there "reaches a length of 16 feet, or a radial spread of nearly 28 feet, but the whole mass is much smaller than that of the decapodous Cephalopods of lesser length. In the *Octopus* above mentioned the body would not exceed 6 inches in diameter and a foot in length, and the arms attain an extreme tenuity toward their tips." Dr. W. O. Ayres tells me that he has often seen this species exposed for sale in the markets of San Francisco (where it is eaten chiefly by the French), and that specimens with the arms 6 or 7 feet long are common. A smaller specimen, presented to the museum of Yale College, was over 4 feet long and weighed 14½ pounds.

Prof. W. H. Brewer states that he has seen specimens in the San Francisco markets which spread 14 feet across the outstretched arms.

The common *Octopus vulgaris* ("poulpe" or "devil-fish") of the Mediterranean, Bermuda, and West Indies sometimes grows to a somewhat formidable size. According to Verany, the largest one seen by him was 9 feet long and weighed 25 kilograms (Tryon). This one was captured by a fisherman with his hands only.

A large species, perhaps the same, occurs in the West Indies. According to Prof. B. G. Wilder,† a correspondent, Mr. J. S. George, of Nassau, New Providence, mentions in a letter the occurrence there of an *Octopus* "10 feet long, each arm measuring 5 feet; the weight was estimated at between two hundred and three hundred pounds." It was found dead on the beach. This estimate of the weight is altogether out of proportion to the measurements given, which would correspond to a weight of not more than thirty or forty pounds at the utmost.

Specimens of similar size have been recorded from other parts of the world, while more or less fabulous accounts of more gigantic forms are numerous, especially among the early writers. Fragments of huge species of *Octopus* are said by many writers to have been vomited by wounded sperm-whales, but no scientific examination of any of these has been made. At present it seems most probable that all the large fragments recorded as being vomited by sperm-whales belong to species allied to *Architeuthis*.

There is no satisfactory evidence that any of these species of *Octopus* ever intentionally attack man, or that any one has ever been seriously injured by them. They are rather sluggish and timid creatures, seeking shelter in holes and crevices among rocks. They feed mainly upon bivalve mollusks and crustacea, but will also eat fish, and may, perhaps, like lobsters and crabs, devour the bodies of persons who have been drowned. There

*American Naturalist, vol. vii, p. 485, 1873.
†American Naturalist, vol. vi, p. 772, 1872

is good reason to believe that most of the supposed cases of *Octopus* attacking and drowning persons (like that of an Indian girl of the Oregon coast, often cited), are merely instances of accidental drowning, or suicides, and that the presence of an *Octopus* is a post-mortem circumtance. Their power and ferocity, as well as their size, have often been excessively exaggerated.

Part II.—Monographic revision of the Cephalopods of the Atlantic coast, from Cape Hatteras to Newfoundland.

The number and variety of Cephalopods known to inhabit this coast have been very much increased within a few years, principally through the investigation of the marine fauna carried on by the United States Fish Commission during the past ten years. Many of the newly discovered species have been captured from time to time by the dredging parties of the Fish Commission. Several very interesting new forms have been presented to the Fish Commission by the enterprising and intelligent fishermen of Gloucester, Mass., many of whom have, during the past three years, saved and brought home at all seasons large collections of marine animals of all kinds, including a very large number of new and strange species, of the greatest interest.* Mr. A. Agassiz, while dredging in deep water off the coast, on the Coast-Survey steamer "Blake," last season, obtained three additional new forms, which are also included in this revision. Descriptions of most of these new species have already been published by the writer in various articles in the American Journal of Science, Bulletin of the Museum of Comparative Zoology (vol. viii), Transactions of the Connecticut Academy (vol. v), and Proceedings of the National Museum (vol. iii), but many additional details and some new figures have here been added.

In this revision thirty-two species are included; of these, two are probably extralimital. Of the thirty species of Cephalopods that we now know to belong to this fauna, twenty-five have been added to it within the past ten years; of these, eighteen species have been described as new by the writer; among these were six new genera.

Subclass DIBRANCHIATA, or ACETABULIFERA.

Cryptodibranchiata Blainville, Dict. Sci. Nat., vol. xxxii, p. 172, 1824.
Acétabulifères Férus. & D'Orb., 1835; Céphal. Acétab., pp. v, xxxv, 1.
D'Orbigny, Hist. Cuba, Moll., p. 5, 1853.
Dibranchiata Owen, Trans. Zool. Soc. London, vol. ii, p. 103, 1838.
Antepedia Gray, Catal. Brit. Mus., Moll., vol. i, p. 3, 1849.

Branchial cavity large, containing a single pair of large, highly specialized gills, each having a muscular branchial heart at its base. Siphon used in locomotion, with or without an internal valve, completely tubu-

*The number of separate lots thus brought in and presented to the Fish Commission amounts to over 900. Besides the invertebrates, many new and remarkable fishes are included in these donations.

lar. The interior lateral or basal lobes of the siphon are flexible, and capable of acting as valves to close the opening of the branchial sac by pressing against the inside of the mantle when it contracts. The jet of water thus forced through the siphon by its reaction propels the animal backward or forward, or in any direction opposite to that in which its flexible extremity may be turned.

Body varying in form from subspherical to long-conical. Sides often with fins. Mantle destitute of an external shell. The internal shell, when present, is dorsal,* and may be either horny or calcareous. Sessile arms in four pairs, around the head, provided on the inner surface with suckers or with hooks (modified suckers). Eyes highly developed. Jaws in the form of a sharp, horny beak, the upper jaw shutting into the lower one; jaws hollow and supported by strong internal cartilages. Odontophore usually with seven (rarely five) rows of sharp teeth. An ink-sac opening near the end of the intestine, at the base of the siphon.

The exposed surfaces of the body, fins, head, and arms contain within the skin small sacs or vesicles filled with bright-colored fluids of different colors, but most commonly various shades of purple, brown, red, and yellow. These vesicles are known as chromatophores. They are under the control of muscular fibers, which are so attached to them that, by contracting, they cause the chromatophores to expand into larger, flat, and more or less round spots of color. By the flattening and enlargement of the chromatophores the colored fluids are spread out into thin layers, making them appear of lighter tints. Sometimes the chromatophores overlap each other in several strata when expanded. When their muscular fibers relax the vesicles contract into minute spherical specks, and then appear much darker in color, but are more widely separated, so that the general color is paler. By this means all these animals are able to effect rapid changes in their colors for purposes of concealment, or in accordance with varying conditions of nervous activity. The muscular fibers of the chromatophores are controlled by the nerves of the mantle, and contract by reflex action, and also, apparently, in accordance with the will of the creature. Their contractility often persists for some time after the death of the animal. When freshly-caught specimens are put into alcohol the chromatophores expand.

* In this article, the terms used in describing the form and relations of parts are those in most common use among systematic writers on this group of animals. No attempt is here made to decide the still unsettled questions in regard to the homologies of the arms and siphon with the foot or other parts of Gastropods, nor to apply the later views of Huxley and others as to the general axial relations of the body. For my present purposes I have thought it best to call the oral region the anterior end and the opposite extremity the posterior end; when the animal is in its normal horizontal position, the side which is uppermost is called the dorsal side and the lower surface is called the ventral. The prehensile organs are called sessile arms and tentacular arms, and the locomotive tube is called the siphon, without reference to the homologies of these organs.

This subclass includes two very natural divisions:

Decacera.—Having inside the circle of eight sessile arms, two long tentacular arms, with suckers or hooks on the distal portion. Suckers pediceled, and with horny rims. Body elongated, always with lateral fins.

Octopoda.—Having only the eight sessile arms. Suckers not pediceled, and destitute of horny rings. Body rounded, rarely finned.

Order I.—DECACERA, or DECAPODA.

Decapoda Leach, Zool. Miscel., vol. iii (t. Gray) 1817 (*non* Latr., 1806).
H. & A. Adams, Genera, vol. i, p. 25.
D'Orbigny, Tabl. Méth. des Céphal., p. 57, 1826; Hist. Cuba, Moll., p. 30, 1853.
Decacera Blainville, Dict. Sci. Nat., vol. xxii, 1824; Man. Mal., p. 366, 1825.
Sephinia Gray, Catal. Brit. Mus., Moll., vol. i, p. 35, 1849.

Body generally elongated, often acute posteriorly. Head furnished with ten prehensile arms, bearing pediceled suckers or hooks. Four pairs of arms are shorter, tapering from the base, and covered with rows of suckers along the whole length of the inner face; the fifth pair of arms, known as tentacles or tentacular arms, differing from the rest, and arising from a pair of pits or pouches, are situated between and inside the bases of the third and fourth pairs of sessile arms, and have a long and more or less slender and contractile peduncular portion and a terminal, usually enlarged, sucker-bearing portion. Beak at the end of a protractile pharynx, surrounded with a loose outer buccal membrane, which is usually seven-angled and united to the arms by bridles. Siphon usually with an internal valve. Eyes movable in the sockets, with or without lids. Ears behind the eyes. Head united to the mantle either by a dorsal and two lateral, free, connective cartilages or by three muscular commissures. Mantle cylindrical or conical, supported by an internal dorsal, horny 'pen,' or by a calcareous internal dorsal shell or 'bone;' always with muscular fins along each side, which are usually united posteriorly. Male with one or more of the arms hectocotylized.

This group has been divided by D'Orbigny into the following two tribes, which are, perhaps, more convenient than natural:

Oigopsidæ.—Eyes naked in front, furnished with free lids, with or without an anterior sinus; pupils circular.

Myopsidæ.—Eyes covered by transparent skin, sometimes with a thickened fold, forming a lower lid; pupils crescent-shaped.

OIGOPSIDÆ.

Family TEUTHIDÆ Owen (restricted).

Teuthidæ (*pars*) Owen, Trans. Zool. Soc. London, vol. ii, 1838.
Teuthidæ (*pars*) D'Orbigny, Céphal. Acétab., p. xxxvii (Introduction), p. 328, 1835–'48.
Onychoteuthidæ (*pars*) Gray, Catal. Brit. Mus., Moll., vol. i, p. 45, 1849.
H. & A. Adams, Genera, vol. i, p. 30.

Tentacular arms furnished with sharp horny claws or hooks, which correspond with peculiarly and highly modified sucker-rings; true den-

ticulated suckers may or may not accompany the hooks; tip of arm with a cluster of small, smooth-rimmed suckers; proximal part of club with a mixed group of connective tubercles and smooth-ringed suckers, by which the arms can be fastened together and used in concert. Sessile arms with hooks, with suckers, or with both. Eyes with free lids and a sinus. Mantle united to neck by three simple, movable, connective cartilages. Siphon with a valve and with dorsal bridles. Nuchal or alfactory crests well developed; sometimes several longitudinal crests exist on each side. Pen thin, lanceolate, usually with a posterior hooded portion, and sometimes terminated by a solid cartilaginous cone. Odontophore in *Cheloteuthis* and *Gonatus* with only five rows of teeth, in others with seven rows.

For a synopsis of the hitherto-described existing genera of this family, see pp. 69, 70.

Owen's family *Teuthidæ* included nearly all the *Decacera* having horny internal shells. As adopted by D'Orbigny, it included *Ommastrephidæ* and *Teuthidæ*.

CHELOTEUTHIS Verrill.

Trans. Conn. Acad., vol. v, p. 234, Jan., 1881; Bulletin Mus. Comp. Zool., vol. viii, p. 109, 1881.

Allied to *Enoploteuthis*, *Lestoteuthis*, and *Abralia*, but with a more complicated armature than either of these genera. Ventral arms with denticulated suckers, arranged in four rows; other arms have two median rows of sharp incurved claws, (distal portions have lost their armature). Tentacular arms long, with broad clubs, strongly keeled externally, and with series of connective suckers and tubercles extending for some distance along the inner surface of the arms. Tentacular club provided with a marginal row of connective suckers, alternating with tubercles, along one margin; with a central row of unequal hooks, some of them very large; with submedian groups of small, slender-pediceled suckers (or hooks); with marginal series of small suckers; and with several rows of small suckers covering the prolonged distal portion of the face. Connective cartilages on the base of the siphon simple, long-ovate; the corresponding processes of the mantle are simple longitudinal ridges. Odontophore with five rows of teeth.

The caudal fin, pen, and many other parts are destroyed.

Cheloteuthis rapax Verrill.

Cheloteuthis rapax Verrill, Trans. Conn. Acad., vol. v, p. 234, pl. 49, figs. 1–1*f*, Jan., 1881; Bulletin Mus. Comp. Zool., vol. viii, p. 110, Cephalopods, pl. 2, figs. 1–1*f*, 1881.

Plate XV, figures 3–3*f*, 4.

The body was rather short and thick, tapering rapidly backward. The caudal fin appears to have been short-rhomboidal, but this is uncertain. The siphon is large, with an internal valve. The connective cartilages (fig. 3 *e*) on the sides of the base of the siphon are long-ovate, with the posterior end widest and rounded. The corresponding cartilages on the inside of the mantle are simple longitudinal ridges.

Head large, with very large eyes; pupils round. The arms are long and taper to slender tips; the dorsal ones are smaller and shorter than the others; the lateral and ventral pairs are nearly equal in length, and about as long as the mantle; the ventral arms are somewhat more slender than the lateral ones. All the arms appear to have borne slender-pediceled claws or hooks, with strongly incurved horny points, but only the fleshy parts of these are left, in most cases, and the tips of the arms are bare. On the ventral arms these hooks were smaller, and in four rows; the fleshy portion of these consists of a small rounded head with lateral lobes, running up, on one side, into an incurved beak, so that the shape is somewhat like a bird's head. On the other arms the claws were in two rows only, but they were much larger; in a few cases, on the lateral arms, the horny claws are left. These are strongly compressed and deeply imbedded in the muscular sheath, only the sharp incurved point projecting (figs. 3 *c*, 3 *d*).

The tentacular arms (fig. 3) are long and strong, their length being more than twice that of the sessile arms. The club is rather stout, long, decidedly expanded, and has an elevated, crest-like keel on the distal half of its dorsal surface; this keel rises abruptly at its origin, and is colored on the outer side, but white on the face next to the inner surface of the club. The club is broadest near its base, the distal third is narrow and the tip rounded. The armature is remarkable: in the middle line there is a row of six medium-sized hooks (fig. 3, a''), followed by two much larger ones (a, a'), situated near the middle; these have lost their horny claws; series of minute, slender-pediceled suckers run along the club, either side of the median line, and beyond the large hooks these rows unite and entirely cover the face of the distal third of the club (fig. 3, *d*), there forming about eight rows; at the tip there is a circular group of minute suckers (d'); toward the base of the club the lower side is expanded and bears a row of five peculiar suckers (fig. 3, *e*), having a marginal series of slender, minute, incurved spinules; these suckers have very thick basal processes, which are appressed and directed toward the central line of the club, bearing the suckers on their inner ends, attached by short pedicels; round connective tubercles alternate with these suckers, in the same row; beyond these there is a triangular marginal group of slender-pediceled suckers (*c*), of about the same size; other rows of minute pediceled suckers (or hooks) occupied the submedian area between the marginal ones and the central line, which is indicated by a strong white cord. The opposite margin of the club appears to have borne several rows of small suckers, but this part is badly injured. A band of minute papillæ (e'), apparently the remnants of suckers and alternating connective tubercles, extends downward for more than half the length of the tentacular arm; at first this band is like a continuation of the connective suckers and tubercles on the margin of the club, and the papillæ are apparently in a single row, while the surface near them is crossed by fine transverse grooves or furrows; but

farther down the arms there may have been two or more rows of suckers which have been destroyed.

The beak (fig. 3*f*) is somewhat compressed, with very acute mandibles. The upper mandible has the point long and regularly incurved, with the cutting edge regularly arched, without a basal notch, and forming, with the anterior edge, an obtuse angle. Lower mandible with a strongly incurved tip and regularly concave cutting edge, having no basal notch and only a slight tooth on the anterior border, which forms a very obtuse angle with the cutting edge. The radula has but five rows of teeth (Pl. XV, fig. 4), the inner lateral rows being absent.

Color mostly gone, but where still remaining, as on the back of the tentacular club, it consists of minute purple chromatophores; inner surface of sessile arms purplish brown.

Measurements (in millimeters).

Length of body	78
Length of dorsal arms	58
Length of second pair of arms	86
Length of third pair of arms	87
Length of ventral arms	85
Length of tentacular arms	225
Length of club	29
Breadth of club	7
Breadth of tentacular arms	5
Breadth of lateral arms at base	6
Breadth of dorsal arms	5
Diameter of eyeball	19
Length of connective cartilages on siphon	14
Breadth of the same	4

A specimen of this remarkable squid, in very bad condition, was taken from the stomach of a fish trawled at station 893, in 372 fathoms, about 100 miles south of Newport, R. I. It was accompanied by a specimen of *Ommastrephes illecebrosus*, in a similar condition. It had lost its pen, its epidermis, and most of the horny hooks and sucker-rings; the head was detached from the body and the caudal fin was nearly destroyed; the eyelids were gone, but the eyeballs remained. The description must, therefore, remain imperfect till other specimens can be obtained.

Several loose horny hooks of a Cephalopod belonging to this family were also dredged in the same region. They resemble the hooks of *Onychoteuthis Banksii* (Plate XV, fig. 4), but may have belonged to *C. rapax*. A larger one, from station 892, is bent nearly into a half circle.

GONATUS Steenstrup (*? non* Gray).

?Gonatus Gray, Catalogue Mollusca Brit. Mus., vol. i, Cephal. Antep., p. 67, 1849 (characters inaccurate).
?H. & A. Adams, Genera, vol. i, p. 36.

Body slender, tapering; caudal fins short, broad, united posteriorly. Pen narrow anteriorly, thin and lanceolate posteriorly, with a terminal, hood-like expansion. Ventral arms with four rows of small, pedicellated suckers; others with two larger median rows, with a horny ring, having

a single large hooked claw on the outer edge; outer suckers with longer pedicels, the horny ring with several small dentieles. All the suckers have a circle of minute scales or plates around the aperture. Tentacles long and slender, the terminal part dilated into a narrow club, with a membranous keel; the club is covered with minute denticulated suckers, like the outer ones of the sessile arms; smaller suckers extend for some distance along the arm; center of the club with one or two larger claws, resembling the median ones of the lateral arms, their horny rings having a small aperture, and bearing, on the outside, a large claw-like hook. Odontophore with only five rows of teeth.

By Dr. J. E. Gray the free eyelids of this species were overlooked, and on that account he referred it to the family *Loligidæ*. H. and A. Adams have made the same mistake. Their statement that the siphon has no valve is equally erroneous.

Gonatus Fabricii Steenstrup.

Sepia loligo Fabricius, Fauna Grœnlandica, p. 358, 1780 (good description).
Onychoteuthis Fabricii Lichtenstein, Isis, vol. xix, 1818.
Möller, Kröyer's Tidss., vol. iv, p. 76, 1842.
Loligo Fabricii Blainville, Dict. Sci. Nat., vol. xxvii, p. 138, 1823.
Onychoteuthis? amœna Möller, Ind. Moll. Grönl., Kröyer's Tidss., vol. iv, p. 76, 1842 (young?).
Gonatus amœna Gray, Catal. Moll. Brit. Mus., vol. i, Cephal. Antep., p. 68, 1849? H. & A. Adams, Genera, vol. i, p. 36, pl. 4, fig. 2?).
Gonatus amœnus G. O. Sars, Moll. Reg. Arct. Norvegiæ, p. 336, pl. 31, figs. 1–15 (excellent), pl. xvii, fig. 2 (dentition), 1878.
Tryon, Man. Conch., vol. i, p. 168, pl. 73, fig. 290 (descr. from Gray, fig. from H. & A. Adams, Genera?).
Verrill, Proc. Nat. Mus., vol. iii, p. 362, 1880; Trans. Conn. Acad., vol. v, p. 237, pl. 45, figs. 1–1 *b*, 2–2 *d*, Jan., 1881.

Plate XV, figures 1–1*c*, 2–2*d*.

Body small, elongated, rather slender, tapering backward; front dorsal edge of mantle extending forward in a blunt lobe or angle. Caudal fin very short, but broad, nearly twice as broad as long, the front edges extending forward beyond the insertion as rounded lobes; lateral angles subacute; posterior angle obtuse. Arms stout and rather long, the dorsal and ventral pairs stouter than the lateral. Ventral arms bear four rows of small suckers; on the others the median rows (2 *c*, 2 *d*) are larger than the outer ones, with shorter pedicels, and the very oblique horny ring, having a small opening, is developed into a single, large, hooked tooth on the outer side; around the inner side of the aperture there is a partial circle of small flat scales, in several rows. The suckers of the outer rows (2 *a*, 2 *b*) are about two-thirds as large, with longer and more slender pedicels and with lateral apertures; the horny ring has about five acute-triangular teeth on the outer margin, and there are several rows of small scales forming a broad circle entirely around the aperture. The tentacular arms are long and slender, with broader clubs, which bear a large number of minute suckers, much like

the outer ones of the arms, arranged in many crowded rows, some of which extend beyond the club along the arm; in the middle (fig. 1 *b*) there are usually one or two larger suckers (absent in our specimen), in which the horny ring has a small aperture, and is developed into a large hook-shaped claw on one side, and a complete circle of small plates surrounds the horny ring.

Pen thin and delicate, narrow anteriorly, with slender lateral ribs; posteriorly, for more than half the whole length, expanded into a thin lanceolate form; posterior tip laterally dilated, with the edges involute (fig. 1).

A young specimen of this species, in nearly perfect preservation, was recently presented to the United States Fish Commission by Capt. William Demsey and crew of the schooner "Clara F. Friend." It was taken from the stomach of a cod, off Seal Island, Nova Scotia.

Greenland (Fabricius, Möller). Porsangerfjord, northern coast of Norway (G. O. Sars). Coast of Finmark, in stomach of "coal-fish," abundant (G. O. Sars, Norwegian Exp. of 1878).

D'Orbigny, Gray, and other writers have erroneously referred the *Onychoteuthis Fabricii* (based on the *Sepia loligo* of Fabricius) to *O. Banksii*. The detailed Latin description given by Fabricius applies perfectly to the present species, and not at all to *O. Banksii*. He describes the four rows of suckers on the short arms, the small suckers and two large central hooks on the tentacles, the short caudal fin, etc.

Family OMMASTREPHIDÆ.

Teuthidæ (*pars*) D'Orbig., Céphal. Acétab., pp. xxxvii, 328.
Onychoteuthidæ (*pars*) Gray, Catal. Brit. Mus., Moll., vol. i, p. 45, 1849.
Ommastrephidæ Gill, Arrangement Fam. Mollusks, p. 1, 1871.
Tryon, Man. Conch., vol. i, p. 107, 1879.

Body elongated, tapering to a point posteriorly, shorter and less acute in the female, often very large (*Architeuthis*). Sessile and tentacular arms without hooks, but provided with suckers, having denticulated horny rings; tentacular arms with an expanded club, having four rows of suckers on its middle portion, those in the two central rows larger; proximal portion with or without smooth-ringed connective suckers and tubercles; tip with a cluster of smooth-ringed suckers. Siphon in a deep groove, attached by four bridles and strengthened by a median longitudinal dorsal band, free in the middle; an internal valve. Eyes with a round pupil; lids free, with a distinct anterior sinus. Nuchal or auditory crests consist of three longitudinal membranes on each side, united by a transverse one in front. Connective cartilages of the mantle three; the lateral ones in the form of a longitudinal ridge, with a smaller transverse one across its posterior end; corresponding cartilages on the siphon long-triangular, with a longitudinal and a transverse groove. Two oviducts. Hectocotylized arm of the male either the right or left ventral.

Pen usually very narrow along the middle portion, and with three

ribs; anterior and posterior portions expanded, the latter with the edges involute, and forming a terminal hood or hollow cone.

OMMASTREPHES D'Orbigny (restricted).

Ommastrephes (*pars*) D'Orbigny, Voy. Am. Mérid., 1835; Céphal. Acétab., p. 341.
Illex and *Todarodes* Steenstrup, Oversigt K. Danske Vidensk. Selsk. Forhandl., 1880, p. 90.

Body elongated, pointed posteriorly. Caudal fin broad, transversely rhomboidal. Pen narrowed behind the middle, with a strong median rib and large marginal ribs on each side; near the posterior end thin and concave, expanded into a lanceolate form; at the tip involute and slightly hooded. Head large. Eyes with lids, having a distinct sinus in front.

Arms stout, the third pair usually stoutest, with a dorsal keel; all the arms have marginal membranes, strengthened by transverse muscular ridges, exterior to the suckers. Suckers of the arms deep and oblique, with horny rims, which are strongly denticulate on the outer margin, the median tooth usually largest. Tentacular arms rather long and contractile, stout, with a moderately wide terminal club, which has along its middle region two rows of large central suckers, and a row of smaller marginal ones alternating with them on each side; proximal part of club with small denticulated suckers only; distal part of club with four to eight rows of small denticulated suckers.

Siphon-tube placed in a groove on the under side of the head, and attached to the head by a lateral bridle on each side behind the eyes, and by a pair of bridles on its dorsal surface, at the bottom of the depression in which it is lodged. Terminal orifice transversely elliptical, furnished with an internal valve. The depression back of the siphon is smooth in our species, in some other species longitudinally furrowed.

Mantle-fastenings ("apparatus of resistance"), situated on the basal extension of the siphon, consist of two large triangular bosses, each with an elongated and somewhat car-shaped longitudinal fosse, and a shallower transverse one. On each side of the inner surface of the mantle is a corresponding T-shaped cartilage, consisting of a short, raised, longitudinal ridge, swollen posteriorly, and a lower transverse ridge, which fit closely into the fosses on the siphon. The dorsal side of the head has a median longitudinal facet, that fits upon its counterpart on the mantle, over the anterior part of the pen, which gives it support.

The nuchal crests are formed by a transverse tegumentary fold behind the eyes, from which run backward, on each side, three longitudinal lamellæ, which are delicate, and have a sensory (perhaps olfactory) function.

Buccal membrane seven-angled, thin, corrugated on the inner surface, destitute of suckers.

Branchial auricles and gills large. Liver massive, stomach and cœcal appendage voluminous.

The male has one of the ventral arms (which may be either right or left in our species) hectocotylized near the tip, by an enlargement and flattening of the bases of the sucker-stalks, while their cups become small or abortive.

The female has oviducts developed on both sides, but they are small and simple, opening below the bases of the gills. Two symmetrical nidamental glands, which are comparatively small and simple in our species, are situated behind the heart.

Professor Steenstrup, in the paper last quoted in the above synonymy, has given a revision of the Ommastrephes group. He divides the old genus *Ommastrephes* into three genera, viz: I. ILLEX, which includes *O. illecebrosus*, with *O. Coindetii*, the closely allied Mediterranean form; II. TODARODES, which includes only the well-known *Ommastrephes todarus* of the Mediterranean, to which he restores the name *sagittatus* Lamarck, which has been otherwise employed by other authors during half a century past; III. OMMATOSTREPHES (restricted), which corresponds exactly with *Sthenoteuthis*, established by me in a paper published several months earlier. (Trans. Conn. Acad., v, p. 222, February, 1880.) In another part of his article he refers to my paper, which had been promptly sent to him, but he makes no reference whatever to the genus *Sthenoteuthis*, nor to the species *S. megaptera*, which, as a species, had been described by me still earlier (1878) and in far greater detail than most of the other species which he mentions, and which should, under his system of classification, bear the name of *Ommastrephes megaptera*. Nor does he point out any new characters for distinguishing this generic group other than those first given by me, viz, the presence of connective suckers and tubercles on the tentacular arms, proximal to the club, and the great development of the membranes on the lateral arms. Under the ordinary rule of nomenclature, by which the first correct subdivision made in an older genus shall be entitled to priority, while the original name shall be retained for the remaining group, the name *Sthenoteuthis* ought to be maintained for the division first established by me, while *Ommastrephes* (restricted) should be retained for a part or all of the remaining species.

While I very much regret this confusion of names, I perceive no way to remedy it except by the application of the usual rules of priority. I can certainly see no necessity for the imposition of new names when others equally good were already provided. As for the distinction between *Illex* and *Todarodes*, it seems to me very slight and scarcely of generic importance. *Illex* is characterized by having eight rows of small suckers on the distal part of the club and a smooth siphonal groove. *Todarodes* is characterized by having four rows of distal suckers and some small grooves or furrows at the anterior end of the siphonal groove.

But I have a species (which I refer to *O. Sloanei* Gray) from Tasmania which agrees with *Illex* in having a smooth siphonal groove, but

with *Todarodes* in having only four rows of distal tentacular suckers, and in the sharp denticulation of its large suckers. According to Steenstrup's system this would have to be made still another genus, or else his generic characters would have to be entirely changed in order to admit it into either of his groups. The existence of eight rows of suckers in *Illex* seems to be due merely to the crowding together of the ordinary four rows; nor can we attach much importance to the superficial furrows in the siphon-groove. Therefore, my own opinion is that *Illex* and *Todarodes* should be reunited and should retain the name *Ommastrephes** in a restricted sense. The absence of connective suckers and tubercles on the tentacular arms will be the most important diagnostic character to distinguish it from *Sthenoteuthis* and *Architeuthis*. *Dosidicus* is, perhaps, only an abnormal *Sthenoteuthis* with partially reproduced arms.

Ommastrephes illecebrosus Verrill.—(Short-finned Squid.)

Loligo illecebrosa Lesueur, Journ. Phil. Acad. Nat. Sci., vol. ii, p. 95, plate not numbered, 1821 (figures incorrect).

Blainville, Dict. des Sci. Nat., vol. xxvii, p. 142, 1823.

Gould, Invert. Mass., ed. 1, p. 318, 1841 (habits).

Loligo piscatorum La Pylaie, Ann. des Sci. Nat., vol. iv, p. 319, 1825, pl. 16 (habits as observed at Saint Pierre).

Ommastrephes sagittatus (*pars*) D'Orbig., Céphal. Acétab., p. 345, pl. 7, figs. 1–3 (after Lesueur).

Gray (*pars*), Catalogue Moll. British Mus., part i, Cephal. Antep., p. 58, 1849.

Binney, in Gould's Invert. Mass., ed. 2, p. 510, 1870 (excl. syn.), pl. 26, figs. 341–344 [341 is imperfect]* (*not* pl. 24, fig. 339.)

Tryon (*pars*), Man. Conch., vol. i, p. 177, pl. 78, fig. 342 (very poor, after Lesueur), pl. 79, fig. 343, 1879 (*not* pl. 78, figs. 341, 345).

Ommastrephes illecebrosa Verrill, Amer. Journ. Sci., vol. iii, p. 281, 1872 (synonomy); Report on Invert. Viney. Sd., &c., 1873, pp. 441 (habits), 634 (descr.); Amer. Journ. Sci., vol. xix, p. 289, April, 1880; (*illecebrosus*) Trans. Conn. Acad., vol. v, p. 268, pls. 27, 29, figs. 5, 5 *a*, pl. 37, fig. 8, pl. 38, fig. 2, pl. 39, figs. 2, 3 *a* 3 *b*, 1880–'81.

Illex illecebrosus Steenstrup, Oversigt K. Danske Vidensk. Selsk. Forhandl., 1880, p. 90 (author's separate copy, received August, p. 20).

Plates XVIII–XX.

Body, in the younger specimens, long and slender; in the adults, especially when the stomach is distended with food, and in the breeding season, rather stout; most so in the large females; in preserved specimens the apparent stoutness of the body depends very much upon

* I can see no necessity for the proposed reformation of the original spelling of this word by changing it to *Ommatostrephes*, for usage justifies the elision of a syllable in so long a name. The original spelling has been unchallenged for over forty years.

* This species is not well figured in the last edition of Gould's Invertebrates. Plate 25, fig. 339, which Mr. Binney refers to it, really represents a *Loligo*. Plate 26, figs. 341–344 (erroneously referred to *Loligopsis pavo*), was doubtless made from a specimen of this species, but, if so, the long arms were incorrectly drawn, and confused with the short arms.

whether the mantle was in a contracted or expanded state when the animal died. Caudal fin transversely rhomboidal, or broad spear-shape, about one-third wider than long, its breadth usually less than half the length of the mantle; the posterior borders are nearly straight and form nearly a right angle at the posterior end; the anterior margins are somewhat convexly rounded, and the front margin extends, at the sides of the body, considerably forward beyond the insertion of the fin. Ratio of fin-length to mantle-length 1 : 2.48 to 1 : 3 (the latter in the young ones). Average proportions, in eight adult specimens, of fin-length (from insertion) to length of dorsal side of mantle, about 1 : 2.55; breadth of fin to length of mantle, average, 1 : 1.90; length of head (dorsal edge of mantle to base of arms) to mantle-length, average, 1 : 7.15.

The head is large, well rounded; the exposed portion is shorter than broad, its breadth about equals that of the body, in ordinary contraction; its sides, in the region of the eyes, are somewhat swollen; the under surface is flattened, and has a deep, nearly smooth excavation, semicircular, or rather semielliptical, in outline, to receive the dorsal half of the siphon-tube, which fits into it closely.

The sides of the head, back of the eyes, have a rather prominent, transverse ridge, back of which the head suddenly narrows to the neck. The transverse ridges curve backward slightly and meet on the dorsal side of the head, where they are less prominent. Three thin, lamelliform, erect folds of the skin extend backward from the transverse ridge, on each side of the head; of these the middle or lateral one is about in line with the lower eyelid; the upper one is, at its origin, about midway between the latter and the median dorsal line, but its posterior edge bends downward and joins that of the one below; the lowest of the three is shorter and curves upward, and finally joins the middle one at its posterior edge. These folds form, therefore, in connection with the transverse ridge, two well-defined lateral areas or facets, of delicate and evidently very sensitive integument, placed just in front of the mantle-opening, on each side, where they must be bathed by the inflowing currents of water. A pair of large special nerves extends directly from the cephalic ganglion to these organs. It seems probable to me, therefore, that they are the seat of a special sense, analogous to, if not identical with, that of smell. They are, also, closely connected with the organs of hearing, and the crests may be of some service in concentrating sound vibrations. A small auditory pore is situated within the lower facet.

The pupils are round and the eyes are large, though the opening between the lids is usually rather small, especially in alcoholic specimens. In these the aperture is usually contracted to a small, obliquely-transverse, irregular-triangular form, or even to a narrow oblique slit; when more open, the aperture is still usually somewhat angular; the anterior sinus is narrow and extends downward and forward.

The eyelids form, when nearly expanded, an irregular oval, the longest

diameter placed transversely and somewhat obliquely, while the narrow and deep sinus extends forward and somewhat downward. When partly closed (Plate XIX, fig. 4) the opening between the lids generally becomes more oblong, and sometimes approaches a triangular form.

The mantle is thick and very muscular; its anterior margin has a concave outline beneath, forming a slightly prominent angle on each side; from these angles it advances somewhat to the slight median dorsal angle, which projects forward but little, and does not form a distinct lobe, and sometimes it is hardly noticeable, even as an angle, the transverse outline of the edge on the dorsal side being, in that case, nearly straight, or advancing a very little in the middle.

The sessile arms are rather stout, tapering to acute tips. The dorsal arms are a little smaller and shorter than the others; the second and third pairs are nearly equal in size and length, the second often a trifle the longer; those of the fourth pair are usually intermediate in length between the first and second pairs.

All the sessile arms are stout and armed with similar suckers. Along their inner angles, outside the suckers, they are all similarly provided with marginal membranes, which rise to about the same height as the suckers, on each side. Just proximal to each sucker, on the inner face of the arm, arises a thickened, transverse, muscular fold, that extends to the edge of the lateral membrane, which often recedes between their extremities, so as to have a scalloped outline.

The dorsal arms are a little shorter and decidedly smaller than the others. The two lateral pairs of arms are stoutest and longest, and nearly equal, sometimes one pair and sometimes the other being longest. The ventral arms are a little longer than the dorsal and shorter than the lateral ones. The dorsal and upper lateral arms are trapezoidal in section, with the inner face rather broad. The dorsal arms have a slightly elevated, median dorsal crest, commencing near the base and running to the tip. Those of the second pair have a broader, membranous fold on the lower outer angle, along the whole length. Those of the third pair are stouter than the others, and much compressed laterally, with the outer surface rounded, close to the base, but becoming compressed and keeled farther out, and having a high median ridge or crest along its middle region, becoming narrow toward the tip. The ventral arms are trapezoidal in section, with a narrow fold along the outer angle, which is acute, while the inner ventral angle is rounded.

The tentacular arms (Plate XVIII, figs. 1 *a*, 2) are long; when extended, in fresh specimens, they reach back beyond the base of the caudal fin. They are rather stout, rounded-trapezoidal along the peduncular portion; along the upper-outer angle a thin fold runs from the base to the tip, becoming on the back side of the club a wide carina, which often folds down obliquely toward the upper margin of the club; two less marked folds run along the inner angles, defining a narrow inner face along the whole length, but on this face there are no suckers, except close to where

it begins to expand into the broader face of the club; along the sides of the club the marginal membranes become much wider, rising to a level with the suckers, and have transverse muscular ridges opposite the marginal suckers, producing scalloped edges.

In the male of our species one of the ventral arms (Plate XVIII, figs. 3, 3 *a*) is strongly hectocotylized, somewhat as in *Loligo*. But in this species it is the right arm about as often as the left that is modified. Toward the tip of the arm, for some distance, the pedicels of the suckers, especially of the outer row, become shorter, and the bases of the sucker-stalks become larger, broader, and transversely compressed, while the cups of the suckers themselves decrease rapidly, till they become very minute, and on a number of the most flattened and largest stalks they are entirely abortive, in the case of the medium-sized males, but very close to the tip they may again become normal. The inner row of suckers is more or less modified in a similar manner; but fewer of the sucker-stalks are affected, and these are usually not so extensively altered, though in the larger males many of them are commonly destitute of cups and have the same flattened form as those of the outer row, with which they are usually united along the median line of the arm, forming a zigzag ridge. In a very large male (J), with the right ventral arm modified, the alteration of the sucker-stalks becomes obvious at about the 45th sucker, and there are, beyond this, about 80 modified suckers, extending to the very tip; of these, about 30, in the outer row, are represented only by the flat, lamelliform bases of the sucker-stalks, without cups; on the inner row the small cups extend for about ten suckers farther than on the outer. The lamelliform processes are united medially in a zigzag line along the entire tip. The modified part is about an inch in length. This arm is as long as its mate (though in other specimens it is often shorter); but it is broader, stouter, and more blunt at tip, both the inner face and lateral membrane being increased in width. The younger males, 4 to 6 inches long, have the corresponding suckers less extensively modified, and the cups, though very much reduced in size, are usually present on all or nearly all the stalks.

The portion of the tentacles which bears suckers is always less than half the whole length. The relative size of the suckers varies greatly in both sexes, perhaps in connection with a renewal of their horny rings. But in some extreme cases the loss of the sucker, or of the entire club, and the regeneration of a new one will best explain this variation.

The club is long and moderately broad, gradually widening from the peduncular part of the arm, and tapering at the end to a rather blunt, flattened, and curved tip, which is strongly carinated on the outer side by a thin lamina. The suckers commence a short distance in advance of the expansion of the club. They are at first small, deep cup-shaped, and somewhat scattered, in two alternate rows, but all of these small ones have oblique rims, strongly denticulated on the outer margin with

four or five long incurved teeth, while the inner edge is smooth. Of the small ones, before the commencement of the two median rows of large suckers, there are from ten to fifteen.

The middle region of the club is occupied by two rows of large suckers (fig. 2) and by a row of small marginal ones, on each side, alternating with the large ones. The uppermost of the two rows of large suckers contains one or two more suckers than the lower, and they are also larger. The number in the upper row is seven to nine, in the lower five to seven, the largest specimens having the greater number. Of these, the three to five middle ones in each row are decidedly the largest, and have the edge of the marginal ring nearly smooth and even; at each end of each row the suckers diminish in size and the edge becomes denticulated, at first by the formation of narrow incisions, which leave broad, stout, blunt denticles; but as the suckers diminish in size these become longer, narrower, and more acute; their inner margins remain smooth. The large suckers are broad and moderately deep, somewhat swollen below, and a little oblique. The marginal suckers are much smaller, shallower, more oblique, and have the entire rim finely and sharply denticulated, the denticles being longer and strongly incurved on the outer margin. Beyond the rows of large suckers there is, at first, a small group of sharply dentieulated suckers, in four rows, resembling the marginal ones in form and size; but these rapidly decrease in size and become more crowded, till they appear to form eight crowded rows of very small suckers, with minute apertures, which occupy the entire face of the terminal section of the club to the tip; at the extreme tip there is a cluster of small smooth-rimmed suckers, as usual.

The suckers of the sessile arms are largest on the two lateral pairs, on which they are nearly equal, and the largest are about the same in size as those on the tentacular club, the latter being often the smaller in the males, but usually the larger in the females; those of the ventral arms are smallest; those of the dorsal arms are intermediate in size between those of the lateral and ventral arms. The first few suckers (three to five), at the base of each arm, are smaller than those beyond, but increase regularly in size; they have the edge of the rim nearly entire, or with only a few blunt teeth on the outer margin; then follow about twelve suckers, of the largest size. These large suckers (Plate XIX, figs. 5, 5 *a*) are deep, oblique cup-shaped, somewhat swollen in the middle, with oblique horny rims, which are entire on the inner margin, but on the outer have a large, strongly incurved, acute median tooth, on each side of which there are usually four or five shorter, flat, blunt teeth; but toward the base of the arms these are fewer and shorter, while distally they become more numerous, longer, and more acute, and often the edge is more or less dentieulate nearly all around. The larger suckers are followed by a regularly decreasing series of thirty to forty smaller secondary ones (figs. 6, 6 *a*), not counting the numerous very small ones, within one-third of an inch of the tip. These secondary

suckers grade gradually into the large or primary ones, both in size and form; they are, however, armed with four or five very sharp incurved teeth on the outer margin, of which the median one is longest, while the inner margin is usually entire. They are very oblique and one-sided in form. The membrane around the rim of all the suckers is thickened, but most so on the basal ones; it usually recedes behind the large median tooth, leaving there an emargination.

The outer buccal membrane is not very large; its inner surface is closely covered with lamelliform folds and wrinkles; its border is prolonged into seven acute angles, from which membranes extend to the opposite arms, going to the upper sides of the second and fourth pairs of arms, and to the lower side of the third pair; but the seventh angle is in the median dorsal line, and the membrane from it bifurcates, one-half going to the inner side of each dorsal arm. Immediately around the jaws there is a circular, thickened, rugose oral membrane, with a strongly lobed edge, while its inner surface is radially wrinkled and covered with scattered rounded verrucæ. A plain fold intervenes between this and the outer buccal membranes. The beak and pharynx can be protruded its whole length, when in use. At such times the oral membranes are partially unfolded.

The jaws are sharp and incurved at tip, reddish brown to brownish black in color, with the posterior borders of the laminæ whitish and translucent. The upper mandible has a much incurved tip, with the cutting edges regularly curved, and with a shallow notch at their bases, beyond which the anterior edges rise into a broad, obtuse lobe or low tooth, by which the hardened and dark-colored part, as seen by transmitted light, has the form of a sharp angular tooth, but its actual projection anteriorly is but slight, because the translucent edge beyond it rises to about the same level. The lateral-posterior borders of the frontal laminæ are sinuous and incurved in the middle; the palatine lamina is broad, with the posterior lateral edges incurved and sinuous.

The lower mandible has the extreme tip strongly incurved, forming a slight notch close to the tip, below which the edges are slightly incurved or nearly straight, with a decided V-shaped notch at the base; the anterior edges, beyond the notch, form a triangular tooth of the inner laminæ, but this is obscured, unless viewed by transmitted light, by the outer alar lamina, which rises at its anterior edge, where it is translucent, nearly to a level with the tooth; the inner ends of the alæ are wider than the middle, and broadly rounded; the gular laminæ are short, narrowed posteriorly, with their inner edges incurved, and with a thickened, prominent ventral carina.

The jaws of a large specimen measure as follows: Upper mandible, tip to posterior end of palatine lamina, 22^{mm}; to dorsal end of frontal lamina, 16^{mm}; to posterior lateral edge of same, 9^{mm}; to base of cutting edge, 5^{mm}; inner edge of palatine lamina to dorsal end of frontal lamina, 17^{mm}; lower mandible, tip to inner end of alæ, 13^{mm}; to ventral notch of alæ, 4^{mm};

to ventral notch of gular laminæ, 9mm; to posterior end of same, 16mm; to base of cutting edges, 5mm.

The buccal mass has, on the outer surface of the dorsal and lateral sides, a broad, thin, brown horny plate, with a notch posteriorly, in the median line.

The odontophore (Plate XIX, fig. 3) is remarkable for the length and sharpness of the teeth, especially of the central and outer rows. The median teeth (*a*) have a long and very acute median denticle, with much shorter lateral ones. The inner lateral teeth (*b*) have broad bases and a long and very sharp central denticle, with a much shorter lateral one on the outside. The next to the outer lateral teeth (*c*) are simple, slender, and sharp. The outer lateral teeth (*d*) are much longer, strongly curved, and very acute.

The pen (Plate XVIII, fig. 4) is long and slender, with a slender midrib and strong marginal ribs; the anterior end is thin, broad pen-shaped, subacute; from very near the anterior end it tapers gradually backward to about the posterior fourth, where it becomes very narrow, apparently consisting only of the consolidated lateral ribs and midrib, the former showing on the ventral side a thin groove between them, the latter appearing as a slender ridge on the dorsal side. The posterior portion is narrow-lanceolate in form, with thin edges and a strong midrib, composed of the united marginal ribs of the anterior portion; the thin edges are incurved, so as to give a canoe-shaped form to this portion, and near the tip the edges unite beneath into a short, hood-like tip. Anteriorly the lateral ribs show two grooves on the ventral side, and appear to be composed of three united ribs.

The ground-color of a specimen taken by me in 1870 at Eastport, Me., when first caught, was pale bluish white, with green, blue, and yellow iridescence on the sides and lower surface; the whole body, head, and outer surfaces of arms and fins were more or less thickly covered with small, unequal, circular, orange-brown and dark brown spots, having crenulate margins; these spots were continually changing in size, from mere points, when they were nearly black, to spots 1mm to 1.5mm in diameter, when they were pale orange-brown, becoming lighter colored as they expanded. On the lower side of body, head, and siphon the spots were more scattered, but the intervals were generally less than the diameter of the spots. On the upper side the spots were much crowded and in different planes, with the edges often overlapping, thus increasing the variety of the tints. Along the middle of the back the ground-color was pale flesh-color, with a distinct median dorsal band, along which the spots were more crowded and tinged with green in fine specks. Above each eye there was a broad lunate spot of light purplish red, with smaller and much crowded brown spots. The upper surface of the head was deeply colored by the brown spots, which were here larger, darker, and more crowded than elsewhere, and situated in several strata. The under sides of the arms and fins were colored like the body, except that the spots were smaller and much less

numerous. The suckers were pure white. The eyes were dark, blue-black, surrounded by an iridescent border.

The colors change constantly, when living or recently dead, by means of the continual contraction and dilation of the chromatophores. The different tints pass over the surface like blushes.

In specimens recently preserved in alcohol the same pattern of coloration is usually visible. The dark dorsal band on the body and head, and the dark patches above the eyes, as well as smaller dark patches in front of the eyes, can be plainly seen. In these darker parts the chromatophores are much crowded, and have a purplish brown color, varying to chocolate-brown in specimens longer preserved. On other parts of the body the chromatophores are more scattered and usually reddish brown in color, with a circular or elliptical outline; when expanded, the larger ones are about 1^{mm} in diameter. The under surfaces of the fins, siphon, head, and arms have fewer and smaller spots, and are, therefore, lighter colored, and appear nearly white when these spots are contracted.

A fresh specimen, caught in Casco Bay, in 1873, had the following proportions: Length of head and body, not including the arms, 221^{mm}; length of caudal fin, 86^{mm}; breadth of fin, 90^{mm}; diameter of body, 35^{mm}; length of upper arms, 80^{mm}; of second pair, 100^{mm}; of third pair, 100^{mm}; of the ventral pair, 90^{mm}; of tentacular arms, 182^{mm}.

Of our species I have measured large numbers of specimens preserved in different ways, and also fresh, and have found no great variation in the form and relative length of the caudal fin, among specimens of similar size and in similar states of preservation, nor do the sexes differ much in this respect. The young, however, differ very decidedly from the large specimens in these proportions. The modes of preservation also cause much of the variation in the proportions of fins and arms to the mantle. The two sexes are probably equally numerous, but in our collections the females usually predominate, and the largest specimens are usually females, though equally large males occur. In 31 measured specimens, in alcohol, from various localities and of both sexes, the average length, from tip of tail to dorsal edge of the mantle, was 176^{mm} (6.96 inches); from tip of tail to insertion of fin, 66^{mm} (2.60 inches). Average proportion of fin to mantle-length, 1 : 2.68. Among these the proportions varied from as low as 1 : 2.48, in some of the larger ones (with mantle above 8 inches), up to 1 : 3 in the smaller ones (with the mantle less than 3 inches long).

The following tables are intended to illustrate the natural variations in the proportion, due mainly to age, and the accidental variations caused by differences in the modes of preservation and strength of the alcohol. The effect of strong alcohol is to shrink the fins relatively more in breadth than in length, and to reduce the diameter of the body and arms out of proportion to their length.

The specimens from Eastport, Me., designated G, H, I, R, were collected at one time, in midsummer, and preserved in the same way, in

alcohol of moderate strength, repeatedly changed; at the present time the strength of the alcohol is about 80 per cent. They are in good condition, moderately firm and not badly contracted. Those designated as D, E, F, N, O, P were also collected at one time, in August, and preserved together. They are in fair condition, but not so well preserved as the former lot. Those numbered ii to xiv were preserved together about the last of July. They were placed in strong alcohol, and are hard and badly contracted. J, K, and L were preserved together, but were originally found dead on the beach and in a relaxed state. They are only moderately contracted by the alcohol.

Measurements of Ommastrephes illecebrosus (in inches).

	O♀*	P♀	D♀	E♀	J♂	I♂	R♂	W♂	Fresh.
Tail to tip of dorsal arms	13.40	13.00	12.75	10.50	13.50	10.50	10.50	8.25	12.04
Tail to tip of second pair arms	14.20	13.70	.....	.....	14.30	10.80	11.10	.....	12.84
Tail to tip of third pair arms	14.20	13.70	13.25	11.00	14.20	11.00	11.20	.....	12.84
Tail to tip of fourth pair arms	13.10	13.60	.....	.....	13.40	10.60	11.00	.....	12.44
Tail to tip of tentacular arms	16.50	17.50	15.5	12.00	15.50	12.20	12.50	.....	16.12
Tail to base of dorsal arms	10.00	9.40	9.00	7.90	10.00	8.30	8.20	6.50	8.84
Tail to center of eye	9.30	8.90	8.25	7.35	9.50	7.75	7.70	.....	.....
Tail to edge of mantle, above	8.60	8.00	7.75	7.10	8.70	7.50	7.20	5.70	.....
Tail to edge of mantle, below	8.20	7.50	7.30	.....	8.10	7.15	6.65	5.38	.....
Tail to insertion of fin	3.30	3.20	3.10	2.75	3.50	2.90	2.80	2.10	3.44†
Breadth of fin	4.20	4.30	4.25	3.78	5.15	3.80	3.90	2.65	3.60
Between lateral insertions	.....	.....	.50	.40	.65	.45	.....	.....	.....
Front edge, outer angle to insertion	2.20	2.20	2.00	1.90	2.50	2.80	2.10	1.45	.....
Outer angle to tip of tail	3.30	3.25	3.15	2.90	3.50	3.00	2.90	2.00	.....
Circumference of body	4.80	4.80	.....	.....	6.50	4.30	4.00	.....	.....
Breadth of body	1.70	1.60	.....	.....	2.15	1.30	1.40	1.10	1.40
Breadth of head at eyes	1.60	1.50	1.35	1.15	1.65	1.20	1.30	1.00	.....
Breadth of eye-opening	.40	.45	.35	.....	.36	.20	.23	.25	.....
Breadth of siphon at bridle	.75	.70	.65	.55	.78	.60	.55	.....	.....
Length of head, mantle to base of dorsal arms	1.40	1.40	1.25	.80	1.30	.80	1.00	.80	.....
Length of dorsal arms	3.75	3.60	3.25	2.70	2.65	2.20	2.43	1.75	3.20
Length of 2d pair	4.30	4.20	4.00	3.15	4.40	2.70	3.12	2.25	4.00
Length of 3d pair	4.10	4.25	4.00	3.00	4.55	2.67	3.15	2.25	4.00
Length of 4th pair	3.60	3.80	3.50	2.80	3.80	2.43	2.75	2.00	3.60
Length of tentacular arms	6.80	8.00	6.50	4.00	5.80	4.00	4.10	4.50	7.28
Length of club	3.30	3.50	2.75	1.85	2.55	1.75	1.90	1.30	.....
Breadth of dorsal arms	.35	.36	.28	.25	.35	.30	.....	.20	.....
Breadth of 2d pair	.45	.44	.35	.30	.45	.35	.....	.25	.....
Breadth of 3d pair	.45	.44	.35	.28	.50	.35	.....	.25	.....
Breadth of 4th pair	.44	.42	.32	.30	.45	.35	.....	.25	.....
Breadth of tentacular arms	.25	.28	.30	.30	.28	.20	.....	.17	.....
Breadth of club	.30	.30	.22	.18	.25	.22	.....	.....	.....
Front to back of 3d pair	.65	.60	.50	.40	.65	.45	.....	.....	.....
DIAMETER OF SUCKERS.									
Largest on tentacular arms	.18	.17	.15	.11	.17	.11	.13	.....	.....
Largest on 3d pair	.18	.16	.14	.11	.20	.14	.14	.....	.....
Largest on ventral arms	.11	.11	.10	.09	.11	.09	.07	.....	.....
PROPORTIONS.									
Fin-length to mantle-length, 1:	2.60	2.50	2.50	2.58	2.48	2.58	2.57	2.71	.....
Fin-breadth to mantle-length, 1:	2.04	1.86	1.82	1.87	1.69	1.97	1.84	2.15	.....
Length* to breadth of fin, 1:	1.27	1.34	1.37	1.37	1.46	1.30	1.39	1.26	.....
Length of head to mantle, 1:	6.14	5.70	6.20	8.87	6.70	9.30	7.20	7.12	.....
Length of dorsal arm to mantle, 1:	2.29	2.22	2.38	2.62	3.28	3.40	2.96	3.25	.....
Tentacular suckers to mantle, 1:	47.77	47,05	51.66	64.54	51.20	68.18	55.38	.....	.....

* The length of the fin, in these tables, means the distance from the lateral insertions to the tip of the tail, which is somewhat less than the extreme length.

Some specimens, included both in this and the following tables, show small differences in their measurements (made at different times), due partly to the different degrees of extension employed in measuring them, and partly to the fact that the alcohol had been changed and its strength altered.

Measurements of Ommastrephes illecebrosus, females (in inches),

	Vineyard Sound.	Newfoundland.	Halifax.	Eastport.	Eastport.	Eastport.	Eastport.	Eastport.	Eastport.	Casco Bay.	Eastport.	Casco Bay.	Cape Cod.	Maine.	Cape Cod.	Cape Cod.	Cape Cod.	Cape Cod.
Sex and designation	♀ K	♀ Q	♀ 10028	♀ O	♀ N	♀ G	♀ P	♀ D	♀ F	♀ U	♀ E	♀ T	♀ x	♀ X	♀ iii	♀ xiii	♀ xiv	♀ ii
End of body to edge of mantle, above	9.50	8.80	8.70	8.70	8.70	8.60	8.10	7.80	7.80	7.45	7.15	6.85	6.25	5.55	4.40	4.15	4.10	4.00
End of body to same, beneath	8.70	8.40	7.90	8.30	8.05	8.10	7.60	7.30	7.20	6.85	7.00	6.50	6.10	5.30	4.00	3.90	3.85	3.70
End of body to origin of fin	3.70	3.50	3.60	3.40	3.50	3.40	3.20	3.10	3.10	3.00	2.80	2.85	2.40	2.15	1.60	1.50	1.40	1.45
End of body to center of eye	10.00	9.60	9.70	9.10	9.00	9.30	9.10	8.25	8.30	7.98	7.60	7.30	6.70	5.80	4.70	4.30	4.20	4.35
End of body to base of dorsal arms	10.50	10.50	10.50	9.90	9.70	10.00	9.85	9.00	8.70	8.20	8.00	7.80	7.20	6.20	5.00	4.60	4.55	4.50
Eye to tip of dorsal arms	4.80	4.70	5.60	4.30	4.45	4.20	4.20	4.00	3.30	3.00	3.50	2.30	2.65	.....	1.65	1.40	1.40	1.35
Eye to tip of 2d pair arms	5.60	5.10	6.30	4.75	4.95	4.40	4.70	4.55	3.90	3.50	3.70	3.25	2.65	2.55	1.85	1.65	1.50	1.45
Eye to tip of 3d pair arms	5.40	5.15	6.20	4.75	4.65	4.30	4.75	4.50	3.65	3.45	3.60	3.30	2.80	2.50	1.80	1.70	1.55	1.50
Eye to tip of 4th pair arms	5.40	5.00	6.15	3.80	4.40	4.20	4.75	4.30	3.60	3.20	3.20	3.20	2.70	.....	1.70	1.60	1.30	1.40
Eye to tip of tentacular arms	8.10	7.00	10.50	7.00	6.00	5.50	8.00	7.00	6.10	4.80	4.60	4.95	3.70	3.40	2.40	2.30	2.00	1.90
Breadth of head across eyes	1.30	1.90	1.50	1.60	1.50	1.55	1.30	1.35	1.20	1.35	1.15	1.10	1.05	1.00	.80	.70	.70	.70
Breadth of head in front of eyes	1.45	1.65	.....	1.40	1.50	1.50	1.30	.....	1.10	1.25	.....	1.00	1.00	.....	.70	.70	.60	.60
Breadth of body	1.72	2.35	.....	1.60	1.90	1.85	1.00	.....	1.20	1.50	.....	1.25	1.20	.....	.80	.80	.70	.80
Breadth of caudal fins	5.50	5.50	5.30	4.15	4.85	5.00	4.30	4.25	4.00	4.05	3.85	3.70	3.10	2.85	2.20	2.05	1.90	1.95
Circumference of body	5.65	6.80	.....	4.70	5.25	5.80	4.75	.....	3.90	4.40	.....	3.70	3.50	.....	2.20	2.25	2.20	2.10
Length of tentacular club	2.85	2.70	4.20	3.20	2.75	2.60	3.15	2.75	2.00	2.00	1.85	1.90	1.55	1.55	1.10	.90	.95	.90
Diameter of largest suckers of club	.16	.17	.19	.18	.18	.20	.17	.15	.12	.....	.11	.....	.....	.....	.....	.....	.....	.....
Diameter of largest suckers of 3d pair arms	.16	.18	.20	.18	.20	.19	.16	.14	.13	.....	.11	.....	.....	.....	.....	.....	.....	.....
PROPORTIONS.																		
Ratio of fin to length of mantle, 1:	2.56	2.51	2.41	2.56	2.46	2.52	2.53	2.51	2.51	2.48	2.55	2.40	2.60	2.58	2.75	2.76	2.85	2.75
Breadth of fin to length of mantle, 1:	1.72	1.60	1.64	2.09	1.80	1.72	1.88	1.85	1.95	1.83	1.85	1.85	2.01	1.95	2.00	2.02	2.16	2.05

Measurements of Ommastrephes illecebrosus, males (in inches).

	Vineyard Sound.	Vineyard Sound.	Eastport.	Eastport.	Eastport.	Vineyard Sound.	Cape Cod.	Cape Cod.	Massachusetts Bay.	Cape Cod.	Cape Cod.	Cape Cod.	Cape Cod.	Cape Cod.	Cape Cod.	Newport.
Sex and designation	♂ J	♂ L	♂ H	♂ I	♂ K	♂ M	♂ ix	♂ vii	♂ W	♂ xii	♂ xi	♂ viii	♂ iv	♂ vi	♂ v	10280
End of body to edge of mantle, above	8.70	8.50	7.80	7.45	7.10	6.80	6.70	6.70	6.15	5.80	5.60	5.55	5.25	4.15	4.05	2.70
End of body to same, beneath	8.10	8.00	7.30	7.10	6.70	6.35	6.15	6.30	6.00	5.70	5.40	5.25	4.80	4.00	3.90	2.60
End of body to origin of fin	3.50	3.30	3.00	2.90	2.80	2.70	2.60	2.60	2.30	2.20	2.20	2.10	2.00	1.50	1.45	.90
End of body to center of eye	9.50	9.30	8.20	7.80	7.50	7.10	6.90	7.10	6.80	6.25	5.90	5.90	5.45	4.40	4.10	3.00
End of body to base of dorsal arms	10.00	10.30	9.00	8.20	8.20	7.80	7.70	7.70	7.10	6.60	6.50	6.30	5.75	4.80	4.50	3.15
Eye to tip of dorsal arms	4.50	4.15	3.05	2.60	2.95	3.30	3.00	2.90	2.70	2.35	2.50	2.10	2.05	1.50	1.35	1.30
Eye to tip of 2d pair of arms	4.90	4.80	3.50	2.95	3.20	3.60	3.30	3.10	3.00	2.65	2.80	2.35	2.30	1.70	1.50	1.65
Eye to tip of 3d pair of arms	4.95	4.90	3.30	2.95	3.40	3.80	3.10	3.00	2.95	2.40	2.60	2.35	2.20	1.70	1.45	1.55
Eye to tip of 4th pair of arms	4.50	4.10	3.10	2.90	3.20	3.35	2.95	2.90	2.70	2.25	2.50	2.00	2.20	1.50	1.35	1.25
Eye to tip of tentacular arms	6.50	5.70	4.40	4.00	4.20	4.85	5.40	4.20	3.70	3.10	3.60	3.30	2.75	2.20	2.15	2.25
Breadth of head across eyes	1.60	1.30	1.40	1.15	1.30	1.00	1.10	1.20	1.20	.90	1.00	1.00	.90	.80	.75	.58
Breadth of head in front of eyes	1.60	1.30	1.25	1.05	1.20	1.00	1.00	1.05	1.00	.85	.90	.90	.80	.65	.70	.46
Breadth of body	2.10	1.75	1.55	1.40	1.35	1.20	1.15	1.10	1.05	1.00	1.15	.95	.90	.70	.80	.60
Breadth of caudal fins	5.15	4.35	4.30	3.60	3.75	3.70	3.40	3.30	3.00	2.70	2.75	2.70	2.60	2.05	1.90	1.35
Circumference of body	6.30	5.60	4.80	4.30	4.05	3.90	3.80	3.20	3.10	3.15	3.30	2.90	2.95	2.40	2.40	.....
Length of tentacular club	2.55	2.50	1.89	1.60	1.85	2.30	2.10	1.65	1.60	1.40	1.50	1.40	1.20	1.00	.95	1.15
Diameter of largest suckers of club	.17	.14	.12	.11	.13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.01
Diameter of largest suckers on 3d pair arms	.20	.16	.15	.14	.14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
PROPORTIONS.																
Ratio of fin to length of mantle, 1:	2.48	2.57	2.60	2.57	2.53	2.51	2.58	2.58	2.67	2.63	2.54	2.64	2.62	2.76	2.80	3.00
Breadth of fin to length of mantle, 1:	1.69	1.95	1.81	2.10	1.90	1.83	1.97	2.03	2.05	2.15	2.03	2.05	2.02	2.02	2.15	2.00

Off the coast of Rhode Island to Cumberland Gulf. Abundant from Cape Cod to Newfoundland. About 100 miles south of Newport, R. I., in 65 to 372 fathoms (U. S. Fish Com.). Vineyard Sound, Massachusetts, rare, large in winter, small in May (V. N. Edwards).

Recent explorations have extended the range of this species much farther southward, in the deep water near the edge of the Gulf Stream. Although we cannot be certain that specimens caught in the trawl were living at the bottom, owing to the possibility of their entering it during its ascent, it is very probable that they do actually inhabit those depths. This is rendered more certain by the fact that we found adult specimens in the stomachs of fishes (*Lophius*) taken at stations 865 and 893. The most southern specimens known were taken by Mr. A. Agassiz, on the "Blake," off Cape Hatteras, in 263 fathoms.

Ommastrephes illecebrosus.—Specimens examined.

Number.	Locality.	When collected.	Received from—	Specimens. No., sex.
10280	Newport, R. I	1872	United States Fish Commission.	1 young.
10027, J	Vineyard Sound	Nov. 2, 1876	V. N. Edwards	1 ♂, left hand.
10027, K	do	do	do	1 ♀.
10027, L	do	do	do	1 ♀.
M	do	May, 1876	do	1 ♂, right hand.
W	Provincetown, Mass	July, 1879	United States Fish Commission.	1 ♂, figured.
	do	do	do	9 ♂.
	do	do	do	5 ♀.
	do	do	do	3 young.
	do	do	do	28 +, duplicates.
	Salem, Mass	Oct. 25, 1873	J. H. Emerton	1 ♀.
	Gloucester, Mass., loc. 233	1878	United States Fish Commission.	1 young.
S. T. U	Casco Bay, Me	1873	do	3 ♀.
X	Off Seguin Island, Me. (50 fathoms).	1879	(Lot. 517) United States Fish Commission.	1 ♀ young.
	Mount Desert, Me	1860	A. E. Verrill	50 +, large.
	Off Cashe's Ledge	1873 (loc. 21).	United States Fish Commission.	1 mutilated.
9693, G	Eastport, Me	1870	A. E. Verrill	1 ♀, large.
9693, H, I	do	do	do	2 ♂, left hand.
9693, R	do	do	do	1 ♂, right hand.
D. E. F	do	1872	United States Fish Commission.	3 ♀, large.
N. O. P	do	do	do	3 ♀.
	do	do	do	1 young.
	Halifax, N. S	J. R. Willis	Smithsonian	Do.
10028	do	J. M. Jones	J. M. Jones	1 ♀, large.
10278, Q	Newfoundland	do	do	Do.
	Cumberland Gulf	L. Kumlein	National Museum	1 mutilated.
865	North latitude 40° 05′; west longitude 70° 23′ (65 fathoms).	1880	United States Fish Commission.	1 adult.
893	North latitude 39° 52′ 20″; west longitude 70° 58′ (372 fathoms).	do	do	Do.
CCCXXXII	North latitude 35° 45′ 30″; west longitude 74° 48′ (263 fathoms).	do	"Blake" expedition.	3 ♀, adult.

Several of the smaller specimens included in this list are so young that it is impossible to determine their sex with certainty without dissection. The hectocotylization of the ventral arm in the male is scarcely recognizable in those with the mantle less than 4 inches long.

The Mediterranean form (*Ommastrephes Coindetii* Verany), usually identified with the *var. b* of *Loligo sagittata* Lamarck, 1799,* is closely

* It seems more probable, however, that Lamarck's description applied rather to *O. Bartramii* (Les. sp.) of the Gulf Stream region. Blainville and others have thus applied it, correctly, as I believe.

related to our species, but if the published figures and descriptions can be relied upon, it can hardly be identical, as D'Orbigny and other writers have considered it. The American form has a more elongated body, with a differently-shaped caudal fin, which is relatively shorter than the best authors attribute to *O. sagittatus*. The figure given by Verany is, however, an exception in this respect, for in it the body is represented about as long as in some of our larger specimens.† It should be remarked, however, that Lesueur's figure of *O. illecebrosus* shows the body too small and too short in proportion to the size of the fin, and the fin wrong in shape and occupying more than half the length of the mantle; the proportions of the arms are also erroneous. But Lesueur explains these defects by his statement that the figures were hasty sketches made for the sake of preserving the colors, and that he saved a specimen by which to correct, afterwards, his drawings and description, but the specimen saved turned out to be *Taonius pavo*, so that the original sketches were published without correction. Tryon's fig. 342 is a poor copy of one of Lesueur's, published without credit to him.

If the European form be really identical with the American, the distribution is very anomalous, for while the former is a Southern European form, inhabiting the Mediterranean and scarcely extending north of the southern waters of Great Britain, where it appears to be rare, our species is a strictly northern, cold-water form, rarely found south of Cape Cod, even in winter, unless in deep water. Its range extends quite to the Arctic Ocean.

Notes on habits.

When living, this is a very beautiful creature, owing to the brilliancy of its eyes and its bright and quickly-changing colors. It is also very quick and graceful in its movements. This is the most common "squid" north of Cape Cod, and extends as far south as Newport, R. I., and in deep water to the region off Cape Hatteras. It is very abundant in Massachusetts Bay, the Bay of Fundy, and northward to Newfoundland. It is taken on the coast of Newfoundland in immense numbers, and used as bait for codfish. It occurs in vast schools when it visits the coast, but whether it seeks those shores for the purpose of spawning or in search of food is not known. I have been unable to learn anything personally in regard to its breeding habits, nor have I been able to ascertain that any one has any information in regard either to the time, manner, or place of spawning. At Eastport, Me., I have several times observed them in large numbers in midsummer. But at that time they

†According to Jeffreys (Brit. Conch., vol. v, p. 229, pl. 5), the English *O. sagittatus* has the fin "from $\frac{2}{3}$ to nearly $\frac{1}{2}$ the length of the mantle;" and the form of the pen, especially of the posterior end, as figured by him, is different from that of our species.

Professor Steenstrup, in a recent article (Oversigt K. Danske Vidensk. Selsk. Forhandl., 1880), separates the Mediterranean from the American form. He restores, in the same article, the name *sagittatus* to *var. a* of Lamarck (= *O. todarus* of most modern authors), which he now calls *Todarodes sagittatus*.

seemed to be wholly engaged in the pursuit of food, following the schools of herring, which were then in pursuit of shrimp (*Thysanopoda Norvegica*), which occur in the Bay of Fundy, at times, in great quantities, swimming at the surface. The stomachs of the squids taken on these occasions were distended with fragments of *Thysanopoda*, or with the flesh of the herring, or with a mixture of the two, but their reproductive organs were not in an active condition. The same is true of all the specimens that I have taken at other localities in summer. From the fact that the oviducts are small and simple, and the nidamental glands little developed, I believe that it will eventually prove that this species discharges its eggs free in the ocean, and that they will be found floating at the surface, either singly or in gelatinous masses or bands, not having any complicated capsules to inclose them. Nothing is known as to the length of time required by this species to attain its full size. It probably lives several years.

This squid is an exceedingly active creature, darting with great velocity backward, or in any other direction, by means of the reaction of the jet of water which is ejected with great force from the siphon, and which may be directed forward or backward, or to the right or left, by bending the siphon. Even when confined in a limited space, as in a fish-pound, it is not an easy matter to capture them with a dip-net, so quick will they dart away to the right and left. When darting rapidly the lobes of the caudal fin are closely wrapped around the body* and the arms are held tightly together, forming an acute bundle in front, so that the animal, in this condition, is sharp at both ends, and passes through the water with the least possible resistance. Its caudal fin is used as an accessory organ of locomotion when it slowly swims about or balances itself for some time nearly in one position in the water.

The best observations of the modes of capturing its prey are by Messrs. S. I. Smith and Oscar Harger, who observed it at Provincetown, Mass., among the wharves, in large numbers, July 28, 1872, engaged in capturing and devouring the young mackerel, which were swimming about in "schools," and at that time were about four or five inches long. In attacking the mackerel they would suddenly dart backward among the fish with the velocity of an arrow, and as suddenly turn obliquely to the right or left and seize a fish, which was almost instantly killed by a bite in the back of the neck with their sharp beaks. The bite was always made in the same place, cutting out a triangular piece of flesh, and was deep enough to penetrate to the spinal cord. The attacks were not always successful, and were some-

* This position of the fins is very well shown in Plate 26, fig. 341, of Binney's edition of Gould's Invertebrata of Massachusetts. This figure was probably drawn by Mr. Burkhardt from living specimens formerly kept in Cutting's Aquarium, in Boston, about 1860 to 1862. This figure is very good, in most respects, except that the clubs of the tentacles have been confounded with the ventral pair of the sessile arms, and thus the suckers are represented as if they extended along the whole length of the tentacles.

times repeated a dozen times before one of these active and wary fishes could be caught. Sometimes, after making several unsuccessful attempts, one of the squids would suddenly drop to the bottom, and, resting upon the sand, would change its color to that of the sand so perfectly as to be almost invisible. In this position it would wait until the fishes came back, and when they were swimming close to or over the ambuscade, the squid, by a sudden dart, would be pretty sure to secure a fish. Ordinarily, when swimming, they were thickly spotted with red and brown, but when darting among the mackerel they appeared translucent and pale. The mackerel, however, seemed to have learned that the shallow water was the safest for them, and would hug the shore as closely as possible, so that in pursuing them many of the squids became stranded and perished by hundreds, for when they once touch the shore they begin to pump water from their siphons with great energy, and this usually forces them farther and farther up the beach. At such times they often discharge their ink in large quantities. The attacks on the young mackerel were observed mostly at or near high-water, for at other times the mackerel were seldom seen, though the squids were seen swimming about at all hours, and these attacks were observed both in the day and evening.

It is probable, from various observations, that this and other species of squids are mainly nocturnal in their habits, or at least are much more active in the night than in the day. Those that are caught in the pounds and weirs mostly enter in the night, evidently while swimming along the shores in "schools." They often get aground on the sand-flats at Provincetown, Mass., in the night. On the islands in the Bay of Fundy, even where there are no flats, I have often found them in the morning, stranded on the beaches in immense numbers, especially when there is a full moon, and it is thought by many of the fishermen that this is because, like many other nocturnal animals, they have the habit of turning toward and gazing at a bright light, and since they swim backwards, they get ashore on the beaches opposite the position of the moon. This habit is also sometimes taken advantage of by the fishermen, who capture them for bait for codfish. They go out in dark nights with torches in their boats, and by advancing slowly toward a beach, drive them ashore. They are taken in large quantities in nets and pounds, and also by means of "jigs" or groups of hooks, which are moved up and down in the water, and to which the squids cling, and are then quickly pulled out of the water. They are also sometimes caught by fish-hooks, or adhering to the bait used for fishes.

Their habit of discharging an inky fluid through the siphon, when irritated or alarmed, is well known. The ink is said to have caustic and irritating properties.

This squid, like the *Loligo*, is eagerly pursued by the cod and many other voracious fishes, even when adult. Among its enemies while young are the full-grown mackerel, who thus retaliate for the massacre of their own young by the squids. The specimens observed catching

young mackerel were mostly 8 to 10 inches long, and some of them were still larger.

This species, like the common *Loligo*, has the instincts and habits of a cannibal, for small squids of its own species form one of the most common articles of its diet. From an adult female of ordinary size (G, of our tables), caught at Eastport, Me., I took a great mass of fragments of small squids, with which the stomach was greatly distended. These fragments completely filled a vial having a capacity of four fluid ounces.

From the rapidity with which the squids devour the fish that they capture, it is evident that the jaws are the principal organs used, and that the odontophore plays only a subordinate part in feeding. This is confirmed by the condition of the food ordinarily found in the stomach, for both the fishes and the shrimp are usually in fragments and shreds of some size, and smaller creatures, like Amphipods, are often found entire, or nearly so; even the vertebræ and other bones of herring are often present. On the other hand, in some specimens, the contents of the stomach are finely divided, as if the odontophore had been used for that purpose.

Notes on the visceral anatomy.

Plate XIX, figure 1. Plate XX, figure 1.

This species, in common with others of the same genus, is very different from *Loligo Pealei* in the form and structure of many of its internal organs. The branchial cavity is larger and the gills (*g*, *g*) originate farther back and are much larger than in *Loligo*, their length being about two-fifths the entire length of the body; they originate back nearly at the middle of the body. The liver (*l*, *l*) is much larger and more conspicuous, consisting of two large, oblong, lateral lobes or masses, closely united together in the median plane, with a groove along the dorsal side, in which lies the œsophagus. The ink-bag (*i*) is elongated-pyriform, with a silvery luster externally, but blackish when filled with the ink. The size and form of the stomach and its cœcal lobe (*s*, *s'*) vary greatly according to their degree of distention with food. When well filled they are very large, saccular, and more or less pyriform, the cœcal lobe extending back nearly to the end of the body. The walls of the stomach are in part thick, muscular, and longitudinally plicated within. The intestine (*h*) has two spatulate papillæ, one on each side of the anal orifice.

The heart (*H*) is large, somewhat irregular and unsymmetrical, with four points, the two lateral continuous with the afferent vessels (*bo*) of the gills; the anterior passing into the anterior aorta (*ao*); the posterior median one, continuous with the posterior aorta, gives off first a small ventral branch, which supplies the reproductive organs, and then, later, a median ventral artery (*o*), going to the mantle; while much farther back it divides into two branches (*o'*, *o'*), which supply the sides of the mantle and caudal fin. The branchial auricles (*au*) are large and ovate, with a small, round capsule at the posterior end.

The anterior urinary organs or 'kidneys' (*r*, *r*) are voluminous, deeply

lobulated organs, intimately united together and connected with the venæ cavæ, and mostly situated below and in front of the heart, but there are two more compact glandular portions (*r'*) extending, as usual, backward along each of the posterior venæ cavæ (*vc''*) in the form of a long pyriform gland. Just in front of the bases of the gills, on each side, there is a circular opening (*u*) through the peritoneal membrane, which probably gives exit to the urinary excretions.

The reproductive organs of the female, however, present the greatest divergence from *Loligo* and allied forms. Instead of having a single large oviduct on the left side only, and opening far forward, we find in this genus two small oviducts (*od*), symmetrically placed and opening much farther back. The ends are free, near the bases of the gills, but behind them, instead of passing over the dorsal sides of the bases of the gills, as in *Loligo* and other genera. The apertures of the oviducts are simple elongated slits. Moreover, instead of the large and very conspicuous, nidamental glands, situated in front of the heart, as in *Loligo*, we find in *Ommastrephes* much smaller and simpler glands (*xx*), situated much farther back, side by side, near the median line, behind the heart.

The ovary (*ov*) is a long, pyriform, lobulated organ; its anterior end is attached to the posterior end of the stomach, and is divided into several short lobes, which clasp the end of the stomach; its small posterior end extends backward into the concavity of the hooded portion of the pen (*p''*).

The spermary or testicle of the male (Plate XIX, fig. 1, *t*) occupies the same position as the ovary; it is a more compact organ, with a smoother surface, and the anterior lobes are longer and narrower and extend farther forward along the sides of the stomach. The prostate gland and other male organs resemble those of *Loligo* (see Plate XXIX, figs. 1, 2).

It must be borne in mind, however, that none of the specimens examined were in their breeding season. Consequently, the reproductive organs were all much smaller and less conspicuous than they would have been in breeding individuals. This is particularly the case with the ovaries and oviducts, but the same remark would also apply to the nidamental glands, which might assume a different form, as well as much greater volume, at the breeding season.

The specimens dissected had all been preserved in alcohol, which would cause these organs to appear smaller than is natural.

STHENOTEUTHIS Verrill.

Ommastrephes (*pars*) D'Orbigny, Voy. Amér. Mérid., Moll. (1835?); Céphal. Acétab., 1839–'48.

Sthenoteuthis Verrill, Trans. Conn. Acad., vol. v, p. 222, Feb., 1880; Amer. Journ. Sci., vol. xix, p. 289, April, 1880.

Ommatostrephes Steenstrup, Oversigt K. Danske Vidensk. Selsk. Forhandl., 1880, p. 89, (sep. copy, p. 19, received Aug., 1880).

This group was instituted to include certain species of squids remarkable for the connective suckers on the tentacular arms, for the large

size and high development of their organs of locomotion, especially of the caudal fin and siphon, and for the presence of a broad, thin web along the lower side of the lateral arms, outside the suckers.

The tentacular arms are, like those of *Architeuthis*, very long, slender, and provided at the base of the club with smooth-rimmed connective suckers, alternating with rounded tubercles, for the mutual adhesion of the two arms; the central part of the club is, as in *Architeuthis*, provided with two central rows of large serrated suckers, and a row of smaller marginal ones on each side, of different form, alternating with them. The lateral arms have a well-developed median crest (most developed on the third pair) along the outer side; on the lower inner angle there is a thin, membranous web, often more than twice as wide as the arm, along the whole length, much more highly developed than in typical *Ommastrephes*, in which a narrow marginal membrane occurs. On the ventral arms the inner face is broader than on the others, and the two rows of suckers are farther apart. The suckers on all the sessile arms are strongly denticulated on the outer side of the rim, with smaller or obsolete teeth on the inner side.

Caudal fin very large, rhomboidal. Internal bone or pen similar to that of *Ommastrephes*, decidedly hooded at the posterior end.

Odontophore with seven rows of teeth; median tooth with three large denticles; inner lateral teeth with two unequal points; two outer laterals simple, slender. Eyes as in *Ommastrephes*.

This group is related on one side to *Architeuthis*, on the other to *Ommastrephes*. The armature of the tentacular arms will distinguish it from the latter, and the large caudal fin and broad membrane of the sessile arms from former.* The dentition of the type is peculiar, so far as known. In addition to the typical species, this genus will doubtless include several species with marginal webs that have hitherto been referred to *Ommastrephes*, but they are often too indefinitely described and figured to show the special characters referred to.

Among those that belong, without much doubt, to this genus, in addition to those described below, are *S. Oualaniensis* (Lesson), and *S. pelagicus* (Bosc), and possibly *O. gigas* D'Orb., though the latter does not have the wide lateral membrane on the arms.

Sthenoteuthis megaptera Verrill.—(Large Broad-finned Squid.)

Architeuthis megaptera Verrill, Amer. Journ. Sci., vol. xvi, p. 207, 1878.

Tryon, Manual of Conchology, vol. i, p. 187 (description copied from preceding paper).

Sthenoteuthis megaptera Verrill, Trans. Conn. Acad., vol. v, pp. 223, 286, pl. 21, figs. 1–9, pl. 27, fig. 6, pl. 45, figs. 5, 5 *a*, 1880–'81; Amer. Journ. Sci., vol. xix, p. 288, 1880.

Plate XVI, figs. 1–10.

Although very much larger and stouter than any of the ordinary squids, this species is much smaller than the species of *Architeuthis*, the

* According to the statement of Gervais, *Architeuthis dux* has similar membranes.

total length of the body and head being but 19 inches. Body relatively short and thick. The caudal fin is remarkably large and broad; it is more than twice as broad as long, and the length is about half that of the body. Its form is nearly rhombic, with the lateral angles produced and rounded and the posterior angle very obtuse, the posterior edge, as preserved, being slightly concave.

The ventral anterior edge of the mantle is concave centrally, with a slight angle on either side, about .75 inch from the center. From these angles it is again concave to the sides. On the dorsal side the edge advances farther forward than beneath, terminating in a slightly prominent obtuse angle in the middle of the dorsal edge. The nuchal crests around the ear consist of a slightly elevated transverse ridge, with three thicker and much more elevated laminæ, which extend forward, on the head, one in the median line of the eye, with one above and one below it, the lower one longest and least elevated, curving downward beneath the head. The two upper ones are broadly rounded at top. Behind the transverse fold there is a deep, irregularly crescent-shaped fosse. The eye-sockets are large, oblong, and furnished with distinct lid-like margins. The eyes are large, prominent, oblong, and naked; the anterior portion is swollen laterally on both sides. The short arms are trapezoidal, the dorsal ones somewhat (about 1.25 inches) shorter, and smaller than the others, which are nearly equal in length, the second pair being stouter than the rest and a little longer. The dorsal arms have a slightly prominent membrane along the outer angles; the subdorsal or upper lateral arms are narrowed to an acute edge or crest on the outer angle, but on the inner angle have a broad, thin, marginal membrane outside the suckers. The lower lateral arms are similar in size and form, and also have a very broad, lateral, marginal membrane next to the suckers, on the lower side. The ventral arms are more slender and a trifle longer, and have narrower marginal membranes. The tentacular arms are slender, elongated, expanded toward the tip, and have suckers arranged much as in the gigantic species, even to the smooth-edged suckers and opposing tubercles proximal to the large suckers, as I have described them in *Architeuthis Harveyi*. The sucker-bearing portion is margined by a scalloped membrane on each side.

The small proximal suckers of the tentacular arms occupy about 44.5^{mm} (1.75 inches) at the commencement of the terminal club; they are about 1.5^{mm} in diameter, circular, regularly cup-shaped, with a nearly even, smooth rim; they are raised on slender pedicels. Alternating with these are smooth, rounded tubercles, which are also on pedicels and slightly larger than the intervening suckers. There are four suckers and four tubercles in the row along the inner margin; along the outer margin there are fewer, smaller suckers, but without horny rings; if they originally had such rings they were probably smaller than the others. The large suckers (Plate XVI, fig. 9) forming the two central rows on the terminal club are furnished with a somewhat oblique dark

brown ring, very strongly and sharply toothed around the outer portion of the edge, and usually with one tooth larger and longer than the rest on the middle of the outer margin; inner margin with much smaller, very acute teeth, of unequal size. The teeth are gold-colored at tip.

Larger suckers of the sessile arms are very oblique, with the rim strong, dark brown, bearing large, strong, sharp, much incurved, unequal teeth on the outer side of the rim; the inner margin is entire. The ventral arms bear about 44 similar suckers, exclusive of the minute ones close to the end; the largest ones are situated beyond the middle of the arm. The lateral arms bear about the same number of large suckers, with numerous minute ones at the tip. The dorsal arms bear, each, about 30 suckers, exclusive of the small terminal ones.

The 22d sucker of the left ventral arm (Plate XVI, figs. 8, 8*a*) has a strong, somewhat elliptical rim, with seven strong and very acute incurved teeth on the outer side, and with the opposite margin on the inner side smooth for more than a third of the circumference. The median tooth on the outer margin is decidedly larger and longer than the others, and abruptly bent inward above its base. It is elongated and gradually tapered to the very acute tip, but thick and channeled externally at its base. To the right and left of this are three similar, but smaller, unequal teeth, all strongly curved inward toward the inner margin, but not convergent to the center. Of these, the second from the central tooth, on each side, is the largest, and the third is the smallest. Between the latter and the smooth inner edge there is a small rounded lobe, or blunt tooth. Peduncle broad toward the rim, tapering rapidly to the slender base. Outer sides of rim much higher than inner. Greater diameter, 10^{mm}; lesser, 7^{mm}; greater interior diameter, 7^{mm}; total height, 13^{mm}; longest tooth, 2.5^{mm}.

The exposed portion of the upper mandible is black; the point is strongly curved, acute, with a smooth cutting edge, separated from the inner lobe by a deep, acute notch; inner lobe or edge of alæ thin, broadly rounded, with a slightly rounded, uneven edge. Length of mandible, 29^{mm}; distance from bottom of notch to tip, 10^{mm}; internal breadth between lobes, 8^{mm}.

The lining membrane of the palate (Plate XVI, fig. 2) is pale, translucent, covered with rather large, whitish, translucent teeth, variable in form and size, but mostly rather broad at base and tapering to an obtuse tip; some are more slender and acute. No granules were detected on the membrane.

The odontophore (Plate XVI, figs. 3–7) was too much injured to show its general form, but it appeared to resemble that of *A. Harveyi*. The lateral membrane was broad in the middle, translucent, white. No plates outside the lateral teeth could be detected. The teeth all have slender, acute tips. The median teeth have three points of nearly equal length; the inner lateral ones have two points, the outer one somewhat shorter and smaller than the other; the two outer lateral teeth are sim-

ple, long, acute, the outermost rather narrower at base and somewhat longer.

Total length, 109cm (43 inches); length of body and head, 48.2cm (19 inches); length of body from dorsal edge of mantle, 35.56cm (14 inches); from ventral edge, 33.16cm (13 inches); of head from edge of mantle to

Measurements of Sthenoteuthis megaptera and S. pteropus (in inches).

	S. megaptera, Nova Scotia.	S. pteropus, Bermuda.	S. megaptera? Sable Island Bank.
Length, tip of tail to end of dorsal arms	25.5	27.5	.....
Length, tip of tail to end of third pair	.....	29.5	.....
Length to end of tentacular arms	43	.....	.....
Length to base of arms	19	20.5	.....
From base of arms to mantle	5	6.25	.....
Tip of tail to edge of mantle (above)	14	14.75	.....
Tip of tail to edge of mantle (below)	13	14.5	.....
Tip of tail to center of eye	.....	18.5	.....
Length of caudal fin (tip to insertion)	6	6.75	.....
Breadth of caudal fin	13.5	11.25	.....
Breadth between lateral insertions	2.33	2	.....
End of body to outer angle of fin	7	7.25	.....
Front edge of fin, from outer angle to insertion	6.5	5.5	.....
Circumference of body	12.5	11.5	.....
Breadth of body	5	4.75	.....
Breadth of head	4	3 +	.....
Diameter of eye-opening (longitudinal)	1.25	1.75	.....
Diameter of eye-opening (transverse)	.75	1.25	.....
Length of tentacular arms	24	.....	.....
Length of dorsal arms (first pair)	6.5	7.25	.....
Length of subdorsal arms (second pair)	8	8.75	.....
Length of subventral arms (third pair)	8.5	9.25	.....
Length of ventral arms (fourth pair)	8	9.25	.....
Breadth of first pair of arms at base	.75	.75	.....
Breadth of second pair of arms	1.12	.80	.....
Breadth of third pair of arms	1.00	.90	.....
Breadth of fourth pair of arms	1.00	.90	.....
Breadth of tentacular arms	.33–.50	.40–.75	.....
Breadth of terminal club of same	.75	.....	.....
Length of siphon in middle	.....	2.5	.....
Breadth of siphon at base	.....	.2	.....
Breadth of aperture of siphon	.....	.1	.....
DETAILS OF TENTACULAR ARMS.			
Length of 'club,' or expanded part	6.5	.....	.....
Length of part bearing large suckers	3.25	.....	.....
Length of 'wrist,' bearing smaller suckers	1.25	.....	.....
Length of tip, with small suckers	1.50	.....	.....
Breadth of 'club' in middle	.75	.....	.....
Breadth of middle of arm	.50	.....	.....
DETAILS OF SUCKERS.			
Diameter of largest suckers of tentacular arms	.40	.....	.....
Diameter of rims of same	.32	.....	.....
Diameter of largest suckers of dorsal arms	.....	.28	.....
Diameter of rims of same	.....	.20	.....
Diameter of largest suckers of second pair	.....	.40	.....
Diameter of rims of same	.....	.28	.....
Diameter of largest suckers of third pair	.....	.32	.....
Diameter of rims of same	.....	.24	.....
Diameter of largest suckers on ventral arms	.40	.30	.....
Diameter of rims of same	.32	.23	.....
JAWS.			
Upper mandible, total length	1.16	1.68	1.25
Upper mandible, tip of beak to bottom of notch	.40	.40	.34
Upper mandible, tip to dorsal edge of frontal lamina	.....	1.32	.98
Upper mandible, breadth between anterior lobes of alæ	.32	.32	.25
Upper mandible, breadth of palatine	.....	.84	.70
Lower mandible, total length	.....	1.16	.91
Lower mandible, depth, end of alæ to mentum	.....	1.12	.87
Lower mandible, beak to notch	.....	.44	.31

base of arms, 12.7^{cm} (5 inches); length of long tentacular arms, 55.8^{cm} and 60.9^{cm} (22 and 24 inches) respectively; of first (dorsal) pair of arms, 16.5^{cm} (6.5 inches); of second pair, 20.3^{cm} (8 inches); of third pair, 21.6^{cm} (8.5 inches); of fourth pair, 20.3^{cm} (8 inches); length of caudal fin, 15.24^{cm} (6 inches); breadth, 34.3^{cm} (13.5 inches); transverse distance between insertions of caudal fins, 5.9^{cm} (2.33 inches); breadth across body in middle, 12.7^{cm} (5 inches); circumference of body, 31.7^{cm} (12.5 inches); length of eye-opening, 3.2^{cm}; its breadth, 1.9^{cm}; length of sucker-bearing portion of tentacular arms, 16.5^{cm} (6.5 inches); of portion bearing large suckers, 8.25^{cm} (3.25 inches); breadth, 1.9^{cm} (.75 inch); length of terminal portion, 3.8^{cm} (1.5 inches); diameter of naked or peduncular portion, .8^{cm} to 1.25^{cm}; breadth of dorsal arms at base, 1.9^{cm}; of second pair, 2.57^{cm}; of third pair, 2.54^{cm}; of fourth pair, 2.54^{cm}; diameter of largest tentacular suckers, 9^{mm} to 10^{mm}; of their rims, 7^{mm} to 8^{mm}; diameter of largest suckers of ventral arms, 10^{mm} (.40 inch); of their rims, 7^{mm} to 8^{mm}.

Color, in alcohol, reddish or purplish brown, specked with darker brown on the dorsal surface of the body; upper side of head and outer sides of arms thickly covered with specks of purplish brown; inner surfaces paler, much as in the common small squids; sides yellowish brown; under surfaces yellowish brown, tinged with purplish.

The original specimen was cast ashore during a severe gale near Cape Sable, Nova Scotia, several years ago, and was secured for the Provincial Museum at Halifax, by J. Matthew Jones, esq. It is preserved entire in alcohol and is still in good condition.

I also refer to this species an entire beak with the odontophore, presented by Capt. George A. Johnson and crew of the schooner "A. H. Johnson." It was taken at Sable Island Bank, Nova Scotia, in 280–300 fathoms, September, 1878. This beak (Plate XVII, fig. 2) has the exposed parts black, the internal laminæ reddish brown. The upper mandible is sharp and strongly incurved, with a small narrow notch at its base, from which runs a raised lateral line; beyond the notch the anterior edge of the ala is convex and slightly uneven. The lower mandible has a small notch below the incurved tip; below this the cutting edge is slightly concave to the basal notch, which is narrow on the right side, but broader and V-shaped on the left; beyond the notch the alar tooth is narrow, prominent, and truncate on the right, but broader and blunt on the left. Opposite the notch and tooth the side of the beak is strongly excavated. Total length of upper mandible, 31^{mm}; hight, palatine to frontal, 24^{mm}; tip to bottom of notch, 8.5^{mm}; tip to dorsal edge of frontal laminæ, 24.5^{mm}; breadth between anterior lobes of alæ, 6.2^{mm}; breadth of palatine, 17.5^{mm}. Total length of lower mandible, 23^{mm}; hight, mentum to inner end of alæ, 22^{mm}; tip to notch, 7.8^{mm}; tip to end of mentum, 8.2^{mm}; tip to dorsal end of gular, 16^{mm}; transverse breadth at alar teeth, 7^{mm}.

The odontophore is similar to that of the typical *S. megaptera*, but the

lateral denticles of the median and inner lateral teeth are relatively shorter, and these, with some other differences, render it doubtful whether this beak actually belongs to that species. The odontophore is 4^{mm} broad; the teeth are all sharp, rather slender, pointed, and pale amber-color. A slight, smoothish, marginal ridge borders the dentigerous zone on each side, but is scarcely divided into distinct plates. The median teeth have three sharp, rather slender denticles, the median about a third longer than the lateral; the inner lateral teeth have a long point, with the acute outer denticle much shorter; the teeth of both outer rows are long, considerably incurved, acute, the outer ones the more slender.

Several additional specimens of this species have recently been received. The most important of these consists of the tentacular club and the pharynx, with the jaws and odontophore complete (Plate XVII, fig. 1). These are from a specimen of which the head and arms were found in the mouth of a codfish on the eastern part of George's Bank, by Manuel D. Mitchel, and were by him presented to the United States Fish Commission. The portions of the specimen not saved were used as bait for cod. The arms were described as 18 inches long.

The part of the tentacular club in my possession, which does not include the proximal portion, is 175^{mm} long, 17^{mm} broad in the middle; the distal portion, beyond the large suckers, is 62^{mm} long; breadth of its sucker-bearing face, 8^{mm}; from front to back, including width of dorsal keel, but not the suckers, 18^{mm}; diameter of largest suckers, 12^{mm}; of horny rings, 11^{mm}; of aperture, 8^{mm}; hight of horny ring, outer side, including teeth, 6.5^{mm}; length of pedicels, 5^{mm}; distance between pedicels, 15^{mm}. The large suckers agree very well with those described and figured from the type-specimen (Plate XVI, fig. 9); this portion of the club had nine of these large suckers in each row; their pedicels arise from the middle of deep squarish depressions, between which run thick transverse ridges, which bear the smaller marginal suckers toward their outer ends, and then support the marginal membrane. A part of the large suckers have retained their horny rings, but all the marginal and small distal suckers have lost them. The horny rings of the large suckers (fig. 10) are oblique, much higher on the outer than on the inner side; the edge bears about 28 sharp, incurved, well-separated, unequal teeth; of these the largest is at the middle of the outer edge; another smaller one, but larger than its fellows, is at the middle of the inner edge; two others, in size similar to the last, occupy the middle of the lateral edges; thus the edge is divided into four equal parts by the four larger teeth, between which there are five or six smaller, very acute teeth, separated by spaces greater than their breadth. The horny rings are amber-brown, the teeth are golden yellow at tip. The distal portion of the club is compressed, with the face narrow and tapering, but with an elevated dorsal keel; it bears four crowded rows of small, pediceled suckers, the two rows on one side of the median line being composed of very much smaller suckers than the

other two. At the very tip of the club there is a round cluster of small, smooth suckers, as in *Architeuthis*. The buccal mass is 52mm in length and 42mm in diameter. A thick buccal membrane, covered with low, irregular verrucæ, surrounds the jaws. The jaws are sharp and strong; their exposed portions are black, the alæ reddish brown. The beak of the upper jaw is long, strongly incurved, acute, its cutting edge regularly curved, with a deep notch at its base, from which a well-defined groove runs downward. The lower jaw is sharp, its cutting edge is most concave near the tip, below which it is nearly straight; sides covered with fine radiating lines; basal notch broad, shallow, angular; beyond the notch there is a broad, low, angular tooth. The surface of the fleshy palate is covered with low, rounded verrucæ. The odontophore is broad, with sharp, pale amber-colored teeth, which agree well with those of the original specimen (Plate XVI, figs. 3–7); outside of the lateral teeth there is a narrow, raised, chitinous ridge, apparently not divisible into plates.

Another specimen, consisting of the buccal mass and jaws, but without the odontophore, was presented to the United States Fish Commission (lot 797) by Capt. Charles Anderson and crew of the schooner "Alice G. Wunson," of Gloucester, Mass.

The jaws of this were slightly larger than in the one just described. They agree well in nearly every respect, but the notch at the base of the lower mandible is narrower and the tooth beyond it broad and rounded.

Measurements of jaws (in millimeters).

Number of lot.	810.	797.
Upper jaw, tip to bottom of notch	12	13
Transverse breadth, at notches	9	10
Tip to end of frontal lamina	38	41
Lower jaw, tip to bottom of notch	11	13
Tip to notch of mentum	11	14
Tip to ventral end of gular lamina	.....	25
Mentum to inner end of lateral alæ	31	36
Breadth of lateral alæ	15	15
Breadth of odontophore, across face	5.5	.....

The fifth specimen, received in lot 879, October, 1880, consists of two of the sessile arms, but the suckers have lost their horny rings, so that the identification cannot be very positive. The largest arm, which is not quite entire, is 255mm long, and 23mm in diameter at the larger end. It was taken from the stomach of a cod, on the Grand Banks, and presented to the United States Fish Commission by the captain and crew of the schooner "Otis P. Lord."

Specimens examined.

Lot.	Locality.	Fathoms.	When received.	Name of vessel.	Received from.	Specimens.
	Cape Sable, N. S.	Beach	.....	.....	Halifax Mus'm	1, entire.
	Sable Island Bank.	280–300	Sept., 1878	A. H. Johnson.	U. S. Fish Com.	1, jaws, &c.
810	George's Bank	Cod stomach.	Aug., 1880	Sultana	....do	1, jaws and arm.
797	East slope G.'s B.	....do	Aug., 1880	Al. G. Wunson.	....do	1, jaws.
879	Grand Banks	....do	Oct., 1880	Otis P. Lord	....do	1, arms.

Sthenoteuthis pteropus Verrill.

Ommastrephes pteropus? Steenstrup (MSS., 1858).
Tryon, Man. Conch., i, p. 179 (no description).
Sthenoteuthis pteropus Verrill, Trans. Conn. Acad., vol. v, p. 228, pl. 27, fig. 7, 7 *a*, pl. 36, figs. 5–9, Feb., 1880; Amer. Journ. Sci., vol. xix, p. 289, Apr., 1880.
Ommatostrephes pteropus Steenstrup, Oversigt K. Danske Vidensk. Selsk. Forhandl., 1880 (received Aug.), pp. 76–81, fig. 7, p. 79, fig. 2, p. 81 (details).

Plate VII, figure 2. Plate XVII, figures 3–9.

A large squid, 74.8^{cm} (29.5 inches) long from tail to tip of longest sessile arms, similar in size and form to the preceding, and closely allied to it, has been sent to me by Mr. G. Brown Goode, who obtained it at Bermuda. It is probably the *Ommatostrephes pteropus* of Steenstrup.

The body is stout, acuminate posteriorly; the anterior border of the mantle, beneath, is even, and not distinctly emarginate in the middle.

The caudal fin is large, broad, transversely rhomboidal, but neither so broad nor so large proportionally as in *S. megaptera*. The siphon is very large and broad (63^{mm} long by 50^{mm} broad), with a large aperture, 25^{mm} wide. The eyeballs are very large, elongated, measuring, although somewhat collapsed, about 42^{mm} long by 31^{mm} broad. The eye-openings, as distended, are large, oblong, elliptical, with a broad sinus and slightly thickened edges.

The arms are stout and rather long, the third and ventral pairs being nearly equal in length; those of the second pair are about 12.5^{mm} shorter than those of the third; the dorsal ones about 63^{mm} shorter than those of the second; the dorsal arms are 18.4^{cm} long, trapezoidal in form, the outer face convex and about 1.9^{cm} broad; the lateral and inner faces, 1.2^{cm}; along the inner angles there is a narrow membrane, outside the suckers (fig. 7, *a*). Those of the second pair are 24.7^{cm} in length; their transverse breadth is about 2^{cm}; from inner face to outer angle, 1.9^{cm}; along the outer angle, in these, is a thick, acute-edged crest, widest in the middle of the arm; along the lower inner angle, outside the suckers, there is a broad and very thin membrane, 2.5^{cm} or more in width (fig. 7, *b*); along the upper inner angle is a similar membrane, about .6^{cm} wide.

The arms of the third pair are 26^{cm} long (31^{cm} from center of eye to tip of arms); they are compressed, 2.25^{cm} broad at base; on the outer angle, along the middle, there is a very prominent crest (fig. 7, *c*), so that, in this part, the distance from inner face to outer angle is 4^{cm}; along the lower inner angle there is a very broad, thin, delicate web, where widest at least 5^{cm} to 7^{cm} (2 to 2.75 inches) wide; it is considerably torn and may have been still wider; it is widest beyond the middle of the arm; on the upper inner angle the corresponding membrane is about 0.6^{cm} wide (fig. 7, *c*). Transverse, thick, fleshy ridges run out from between the suckers a short distance on these membranes, and then fade out. The ventral arms are 2.25^{cm} broad at base and trapezoidal;

they have a smaller crest along the outer angle, and a narrow membrane along each inner angle.

All the sessile arms bear similar suckers (Plate XVII, figs. 8, *a–c*), all of which are provided with 7 to 13 large, very acute, incurved teeth on the outer margin of the very oblique horny rings, and with much smaller, sometimes rudimentary ones on the inner margin, much as in *S. megaptera*. The largest of all the suckers are near the middle of the second pair of lateral arms, from the sixth to the sixteenth, and especially from the ninth to the fourteenth; the diameter of the ninth is 10^{mm}, the edge of its rim 8^{mm}. On the dorsal arms the eighth to the thirteenth are the largest; the diameter of the ninth is 7^{mm}; edge of horny rim, 5^{mm}. On the third pair the eighth to the fourteenth are largest; the diameter of the tenth is 8^{mm}, its rim 6^{mm}. On the ventral arms the fourteenth to the twentieth are largest; the diameter of the fifteenth is 7.5^{mm}, its rim 5.5^{mm}. On the ventral arms the rows of suckers are more separated than on the other arms, their inner faces being wider. On the lateral arms, toward the base, the two rows are nearer together, while the suckers of each row are distant, so that they almost form one irregular row at first. The suckers are all very oblique, with the horny rims very low or narrow in front, and very high on the outer side; these rings are dark brown, but the teeth have a golden luster.

The thick fleshy margin (fig. 9), outside the denticulated edge of the horny ring, is completely covered all around by a series of thin, bracket-shaped, horny plates, light brown in color, arranged radially and movable with the membrane to which they are attached for the most of their length; both the outer and the inner ends are free and turned upward, like a small tooth or denticle; those of the inner end are mostly acute, and form a circle of minute movable denticles, nearly in line with the large teeth of the horny ring, five to ten occupying the intervals between the large teeth of the largest suckers; those plates that stand opposite the teeth of the horny ring are shorter than the others, and often broader, and have no denticle on the flat or upcurved inner ends, which fit to the form of the base of the tooth in front of them; the outer ends are abruptly bent upward and often inward, forming a denticle or flattened hood, usually rounded at the end. These marginal plates vary greatly in width and form, even on the same sucker, according to position, and small, imperfectly developed, wedge-shaped ones are interpolated between the larger ones, around the periphery.

One of the largest suckers, the twelfth of the second pair of arms (fig. 8, *b*, *b'*), has 22 teeth on the horny ring; of these five are small, but sharp, on the middle of the inner border; nine, on the outer border, are largest; and four, on each side, are intermediate in size. The median tooth on the outer margin is largest, and the one next to it, on each side, is a little smaller than the second one from it. The thirteenth sucker of the ventral arms has, on its ring, eighteen denticles; of these nine are very large, with the median more decidedly the largest, and the one

on each side of it is shorter as compared with the next; six, on the inner margin, are minute, and these are connected with the larger series by one or two somewhat larger ones at each end of the inner border.

The stumps of the tentacular arms are flattened, oval, and smooth, measuring about 10mm by 18mm near the base; their length is about 28cm (11 inches), which is doubtless less than half their original length.

According to Steenstrup (op. ult. cit., p. 81, fig. 2), there are, in his example, a few connective suckers and tubercles on the proximal part of the club.

The siphon is very large and lodged in a broad groove in the lower side of the head; the anterior part of this groove, which is separated from the rest by a transverse fold of the skin, is covered by about twelve narrow, longitudinal ridges, separated by strong longitudinal furrows; an additional outer ridge, on each side, is separated from the others by a wider interval; several of these ridges and furrows extend backward beyond the transverse fold. The dorsal side of the siphon is strengthened by a thick, longitudinal, muscular band, which becomes free from the siphon farther back, and is united to the head by a small median connective strap; either side of this are the two broad connective bridles, and at the sides of the siphon, near the ears, on each side, is a broad lateral connection between the mantle and head, with a large aquiferous opening beneath it.

The exposed parts of the jaws (Plate XVII, figs. 3, *a*, *b*) are black and polished; the laminæ are reddish brown, with broad, thin, yellowish-white margins. The upper mandible has a long, sharp rostrum, with regularly curved cutting edges, and a small, well-defined, V-shaped notch, from which a short groove runs backward, beyond which there is a slight ridge; anterior edge of alæ, beyond the notch, forming no distinct lobe or tooth, but slightly convex and irregularly crenulate; posterior lateral borders of alæ with a broad sinus in the middle; palatine lamina long and thin, with sinuous posterior margins; frontal lamina broad, extending well backward.

The total length of the upper mandible is 42mm; tip to posterior end of frontal lamina, 33mm; to notch, 10mm; greatest breadth (or hight), from palatine to end of frontal, 30mm; transverse breadth, across frontal, 15mm; transverse breadth, across anterior edges of alæ, 8mm.

The lower mandible has a strongly incurved beak, with the cutting edges rather suddenly incurved at about the proximal third, and a well-developed, broad, V-shaped notch at base, beyond which there is a slightly prominent, broad tooth; alæ broad, the inner ends broader than the middle, well rounded; mentum short, with a broad dorsal emargination; gular lamina short, the inner edges incurved.

The total length of the lower mandible is 29mm; tip of beak to end of mentum, 10mm; to ventral end of gular, 21mm; to bottom of notch, 11mm; to inner ends of alæ, 24mm; breadth, from inner ends of alæ to mentum, 28mm; breadth of gular lamina, 17mm; breadth of alæ, 12.5mm; greatest

transverse breadth, across alæ, 32mm; transverse breadth, across anterior edges of alæ, at teeth, 11mm.

These jaws agree pretty nearly in form and size with those of *O. pteropus*, as figured by Steenstrup, but the latter have a deeper notch in the upper mandible, with a more evident lobe beyond it, while the lower mandible has a broader and less triangular notch.

The buccal membrane is large, thin, prolonged into seven acute angles or lobes, of which the upper is in the median plane, opposite the interval between the dorsal arms; the six others are opposite the three other pairs of sessile arms. The inner surface of this membrane is covered, near the periphery, with small rounded papillæ; externally it is connected to the arm by seven membranous bridles, corresponding to the seven angles; of these the dorsal one forks, one branch going to the inner margin of each dorsal arm; the upper lateral ones join the marginal membrane of the upper angle of the upper lateral arms; the lower lateral ones join the lower marginal membrane of the third pair of arms; the ventral ones join the marginal membrane outside of the sucker-bearing face of the ventral arms. In front of the bases of each of the dorsal and tentacular arms there is a large opening to the space beneath this membrane.

The beak is closely surrounded by a thick, prominent, lobed, and wrinkled fleshy collar, with papillæ on its inner surface; outside of this there is a smooth, sharp-edged, erect collar, less prominent than the inner one.

The odontophore is similar to that of *Ommastrephes;* it is sharply bent upon itself anteriorly, with the ventral end less than half as long as the dorsal; the dentigerous zone is yellowish brown in color, and bordered laterally by a thin ridge formed by a row of small plates; the lateral membrane is broad, thin, and pale yellow, running straight across, from the ventral end, at right angles to the dorsal portion, and then folding back upon itself joins the dorsal part of the odontophore farther back, near its middle; beyond this point it is very narrow and rolled in. Length of the dorsal portion, 19mm; of the ventral, 9mm; breadth of the dentigerous zone, anteriorly, 5mm; breadth of marginal membrane, anteriorly, 7mm.

The median teeth (Plate XVII, fig. 4, *a*) are broad, with three stout points, the middle one nearly twice as long as the lateral; the inner lateral teeth (*b*) are much longer, with one long stout point and a short denticle on the outer side, below the middle; the two outer rows (*c*, *d*) have simple, long, and rather stout, curved teeth, those of the outermost row a little longer and narrower than the others. The teeth differ decidedly from those of *S. megaptera* in the shortness of the lateral denticles of the median and inner lateral teeth; moreover, all the teeth are stouter and less acute.

The pen (Plate XVII, figs. 5, 5 *a*) resembles that of *Ommastrephes;* it is long, widest anteriorly, bordered by strong ribs, obtusely pointed at the

anterior end, gradually narrowing to the very narrow slender portion about three inches from the posterior end, beyond which there is a thin margin, which expands into a lanceolate form, widest at 1.25 inches from the end; the terminal portion forms a short, hollow hood, formed by the infolding of the margin, and marked by slender, divergent, raised lines, stronger laterally, and with a dorsal keel. The central rib begins at the anterior end, increases in size to the middle region, then narrows to the slender part, where it forms a slender, prominent rib, only visible dorsally, and then becoming confluent with the lateral ribs extends as a sharp keel to the end. The lateral ribs commence at about .75 inch from the anterior end, and each at first consists of three riblets; farther back another appears on the outside margin, but is separated only by a slender groove, and toward the slender part of the pen they all coalesce into a single rib on each side, which nearly meet in the middle line ventrally, where they are separated by a slender groove, which disappears farther on. Total length of pen, 349^{mm} (13.75 inches); greatest breadth, 22.5^{mm} (.90 inch); length of posterior cone or hood, .9^{mm} (.35 inch); breadth of posterior expansion, 15^{mm}.

This specimen is entire, except that it has lost the clubs of the tentacular arms. It is in fair condition, though considerably contracted by long preservation in too strong alcohol. The head, however, has been pulled out from the mantle to an unnatural extent, so as to increase the total length from 3^{cm} to 4^{cm} at least. The ventral arms do not show any of the sexual modifications characteristic of the male squids, therefore, it is doubtless a female.

Most of the measurements are given in the table with those of *S. megaptera* (p. 103); some of the more general are as follows: Length from end of body to tip of dorsal arms, 69.8^{cm} (27.5 inches); to edge of mantle, dorsally, 37.5^{cm} (14.75 inches); to base of dorsal arms, 52^{cm} (20.5 inches); to center of eye, 47^{cm}; to lateral insertions of fin, length, 17^{cm} (6.75 inches); to outer angle of fin, along posterior edge, 18.4^{cm} (7.25 inches); breadth of fins transversely, 28.5^{cm} (11.25 inches); outer angle to lateral insertion, along front edge, 14^{cm} (5.5 inches); between lateral insertions, 5^{cm} (2 inches); breadth of body, 11.9^{cm}; circumference of body, 29.2^{cm} (11.5 inches).

This specimen, which was obtained at Bermuda, by Mr. G. Brown Goode, now belongs to the museum of Wesleyan University, Middletown, Conn. Mr. Goode informs me that it was picked up on the north shore of the island, in December, 1876, and that it was regarded by the inhabitants as a novelty or great rarity, and was noticed as such in the local newspapers.

Stenoteuthis pteropus has been recorded from the Mediterranean Sea and the warmer parts of the Atlantic Ocean.

Sthenoteuthis Bartramii Verrill.

Loligo sagittatus (*pars*) Lamarck, 1799; Anim. sans Vert., vol. vii, p. 665.
Loligo Bartramii Lesueur, Journ. Phil. Acad., I, vol. ii, p. 90, pl. 7, 1821.
Blainville, Dict. Sci. Nat., vol. xxvii, p. 141, 1823.
Loligo sagittatus Blainv., Dict. Sci. Nat., vol. xxvii, p. 140.
Ommastrephes Bartramii D'Orb., Voy. Amér. Mérid., Moll., p. 55, 1838 (t. Gray); Céph. Acétab., pl. 2, figs. 11–20; Hist. Cuba, Moll., p. 59.
Gray, Catal. Moll. Brit. Mus., Cephal. Antep., p. 62, 1849.
Verrill, Invert. Vineyard Sound, &c., p. 341 [635], 1874 (*non* Binney in Gould, Invert. Mass.).
Tryon, Man. Conch., vol. i, p. 180, pl. 80, figs. 361, 362 (after D'Orb.).
Sthenoteuthis Bartramii Verrill, Trans. Conn. Acad., vol. v, p. 223, Feb., 1880; p. 288, Jan., 1881; Amer. Journ. Sci., vol. xix, p. 289, Apr., 1880.
Ommatostrephes Bartramii Steenstrup, Oversigt K. Danske Vidensk. Selsk. Forhandl., 1880, p. 79, fig. 2, p. 81, fig. 3, p. 89; auth. sep. copy (received Aug.), p. 9, fig. 2, p. 11, fig. 3, p. 19.

Body cylindrical, elongated, slender, tapering but little in front of the fin; anterior edge of mantle with a very slight median dorsal angle. Caudal fin short and transversely rhomboidal, with the outer angles acute, posterior angle obtuse, and the front edges rounded and projecting forward beyond the insertion. Length of fin (from insertion) to its breadth, as 1 : 2; length of fin to mantle, as 1 : 2.80, in a young female specimen with the body 3.25 inches long. Head short, as broad as the body; eye-opening angular, higher than long, with a narrow, oblique sinus. Nuchal crests nearly as in *O. illecebrosus*, consisting of a low, transverse, undulated ridge extending around both sides to the dorsal line, and with three raised longitudinal crests on each side. Siphon large, sunken in a deep pit; anterior border of the pit with a series of 6 to 12 or more (varying with age) small and short furrows, which extend inward only a short distance from the edge. Arms rather short, not very unequal; the dorsal ones are a little the shortest and smallest; the third pair are the longest, the second and fourth pairs are intermediate in length and nearly equal; the arms of the second pair are furnished with a well-developed membrane along the lower outer angle, and with a thin marginal membrane of moderate width along the inner angles, outside the suckers, that on the lower side extending beyond the suckers. Those of the third pair are compressed, with a well-developed membranous keel on the median outer edge, beyond the basal portion; on the lower inner angle there is a broad, thin, marginal membrane, extending beyond the suckers, and a narrow one on the upper side; the dorsal and ventral arms have narrow marginal membranes. Suckers of the dorsal and lateral arms furnished with horny rings, which have the edge divided into small, acute-triangular teeth, largest on the outer side; on the ventral arms the suckers are smaller, those on the proximal half of the arm having smooth-edged rings, while those on the distal portion are sharply toothed on the outer edge. Tentacular arms slender and moderately elongated, with distinctly broader clubs, which are keeled on the back side and furnished with a thin marginal membrane on each edge. The suckers form two median alternating rows

of larger, oblique, dentate ones, of which seven to nine in each row are decidedly the largest; alternating with these, on each margin, there is a row of smaller, more oblique, sharply denticulate, marginal suckers; distal face of the club narrowed and covered with four rows of minute crowded suckers, and a small cluster at the tip; the proximal part of the club has an irregular group of few, small, denticulate suckers, beyond which, extending down on the upper margin of the arm, is a row of about five or six or more small, smooth-edged, connective suckers, alternating with small round tubercles of corresponding size; along the lower edge of the arm, for about the same distance, there is a row of more minute pediceled suckers. The horny rings of the larger median suckers are oblique, and the edge is divided into many small slender teeth, longer on the outer or higher margin; the teeth of the marginal suckers are similar, but more unequal and more incurved.

Specimens in alcohol generally show a distinct dark purplish brown dorsal stripe, where the chromatophores are very much crowded.

According to D'Orbigny (Hist. Cuba, Moll., p. 62) the colors of this species, when living, are very brilliant, and are continually changing. Along the middle dorsal line there is a broad violet stripe, with a stripe of reddish yellow on each side of it. These bands are closely defined, and do not grade into each other. Body elsewhere bluish; fins rosy, with a carmine-red tint each side of the darker median stripe. The surface is throughout covered with small reddish-violet chromatophores. The head is dark violet above, rosy beneath. Upon the eyes there are two elongated spots of brilliant blue, and below a spot of bright red.

The color of the ink, according to the same authority, is not black, but coffee-and-milk color. It is emitted very rapidly and discolors a large area. Length of body, 150^{mm}; diameter, 27^{mm}; diameter of head, 29^{mm}; length of tentacular arms, 75^{mm}; length of dorsal arms, 42^{mm}; length of third pair, 56^{mm}; length of fourth pair, 50^{mm}; length of caudal fin, 60^{mm}; breadth of fin, 95^{mm}.

A young specimen, in alcohol, has the following dimensions: Total length to tips of lateral arms, 121^{mm}; tail to base of arms, 93^{mm}; body, 82^{mm}; length of caudal fin, to insertion, 29^{mm}; its breadth, 58^{mm}; diameter of body, 16^{mm}; length of tentacular arms, 48^{mm}.

Middle Atlantic and West Indies to Brazil and Cape of Good Hope. Ranges chiefly between 35° south and 35° north latitude; common in the region of the Gulf Stream.

This is an exceedingly active species, swimming with great velocity, and not rarely leaping so high out of the water as to fall on the decks of vessels.* On this account it has been called the "*flying squid*" by sailors.

* D'Orbigny (Hist. Cuba, Moll., p. 62) relates that in a beautiful night in October, at 34° south latitude, off South America, he himself saw two specimens leap out of the water so high as to fall on the deck of the vessel, which was nearly fifteen feet above the surface of the water. It is supposed that this is done in their efforts to escape from predatory fishes that pursue them.

This is a more slender species than *O. illecebrosus*, with a shorter fin, and it has but four rows of small suckers on the distal part of the club, instead of eight. The most important differences, of generic value, are the presence of connective suckers and tubercles on the tentacular arms, and the great development of the marginal membranes on the lateral arms. The grooves in the siphon-pit are of comparatively little importance.

ARCHITEUTHIS Steenstrup (see page 23).

This genus, which includes the most gigantic species known, differs from *Sthenoteuthis* mainly in having a smaller and differently shaped caudal fin, and in lacking the broad lateral membranes on the lateral arms. The pen is also different, judging from the portions preserved. The large tentacular suckers are more evenly and regularly denticulated; and those of the sessile arms are smaller, with less claw-like teeth.

From *Ommastrephes* it differs in the form and size of the fin and pen, and especially in having connective suckers and tubercles at the bases of the tentacular clubs.

Architeuthis Harveyi Verrill (see pages 23–40).—Giant Squid.

(Plates I–VI.)

Fishing banks off Nova Scotia to Labrador. Northern Europe?

Architeuthis princeps Verrill (see pages 41–50).—Giant Squid.

(Plates VII–XI.)

Newfoundland and the Grand Banks to Labrador. Northern Europe?

FAMILY MASTIGOTEUTHIDÆ Verrill.

Bulletin Mus. Comp. Zool., viii, p. 100, March, 1881.

Body slender, pointed behind. Caudal fin large, rhombic. Mantle united to neck by three movable cartilages. Siphon with an internal valve and one pair of dorsal bridles. Eyes large, not prominent; lids free, simple. Buccal membrane 6-angled, without suckers. Arms free; suckers in two rows. Tentacular arms (in the typical species) not expanded into a club, the terminal portion round, tapering, covered with a multitude of minute suckers, in many rows. No auditory crests. Pen narrow, with a long, hollow posterior cone.

This family differs from *Ommastrephidæ* in lacking distinct lachrymal sinuses and auditory crests, in the remarkable character of the tentacular arms, and in the simple connective cartilages. From *Chiroteuthidæ* and *Histioteuthidæ* it differs in having the siphon provided with a dorsal bridle and internal valve, as well as in the armature of tentacular arms.

It is doubtful whether *Calliteuthis* belongs near this family, its tentacular arms being unknown, and its pen being entirely different. Possibly it may belong to the *Chiroteuthidæ*.

MASTIGOTEUTHIS Verrill.

Trans. Conn. Acad., vol. v, p. 296, Jan., 1881; Bulletin Mus. Comp. Zool., vol. viii, p. 100, March, 1881.

Body elongated, tapering to a point, confluent with the caudal fin posteriorly. Caudal fin very large and broad, rhomboidal, occupying about half the length of the body. Mantle fastened to the base of the siphon by an ovate, ear-shaped, elevated cartilage, on each side, fitting into corresponding deep, circumscribed pits on the base of the siphon. Siphon with a bilabiate aperture, an internal valve, and a pair of dorsal bridles. Eyes large, with round pupils; lids free, thin, apparently with a very small anterior sinus. Arms very unequal, the ventral ones much the longest. Suckers small, in two regular rows. Tentacular arms long and round, tapering to the tips, shaped like a whip-lash, without any distinct club; the distal portion is covered nearly all around with exceedingly numerous and minute suckers, which leave only a very narrow naked line along the outside. Pen narrow and bicostate anteriorly, very slender in the middle; posteriorly much larger, with a long tubular cone (figs. 1 *b*, 1 *c*). This remarkable genus differs widely from all others hitherto described in the character of the tentacular arms and suckers. This, with the great size of the caudal fin, gives a very peculiar aspect to the species.

Mastigoteuthis Agassizii Verrill.

Bulletin Mus. Comp. Zool., vol. viii, p. 100, pl. 1, fig. 1, pl. 2, figs. 2, 3–3 *e*, 1881; Trans. Conn. Acad., vol. v, p. 297, pl. 47, pl. 49, figs. 2, 3–3 *e*, Jan., 1881.

Plate XXI. Plate XXII, figures 2–2 *d*.

Body elongated, round anteriorly; posteriorly tapering rapidly to the slender, acute, terminal portion, which is confluent with the caudal fin to the tip. Front dorsal edge of mantle emarginate in the middle. Caudal fin very large and broad, transversely rhomboidal, obtuse posteriorly, its length, from origin to tip, about equal to half the combined length of the head and body. Eyes large, with thin lids, which appear to have had a distinct but very small sinus in front; pupils circular; iris brown, in alcohol. Sessile arms very unequal; ventral arms much larger and longer than the others, about equal to length of head and body; dorsal arms very small, scarcely one-third the length of the ventral pair; two lateral pairs nearly equal, decidedly longer and stouter than the dorsal pair. A delicate, thin, marginal membrane extends along the arms, outside the rows of suckers, to the slender tips. Suckers small, in two regular rows on all the arms, subglobular, with small oblique apertures, surrounded by small horny rings, which have a nearly entire margin, and by several series of minute plates (Plate XXII, fig. 2 *d*).

Basal web, between the arms, very small. In the smaller specimen, which is a male, the right ventral arm is longer than the left, and the tip appears to have been flattened, and the marginal membranes seem

to have been wider, with the edges infolded, so as to form a sort of furrow on the outer side, but the suckers are mostly gone, and it is too much injured to be accurately described. Tentacular arms long, more than twice the combined length of the head and body, slender, round, gradually tapering to the tip, like a whip-lash, the distal half of their length covered with very numerous, crowded, minute, pediceled suckers (fig. 2 *b*), which cover nearly the entire surface along the terminal portion, leaving only a narrow naked line along the back, but farther from the tip this naked space becomes gradually wider and the band of suckers narrower, and after these crowded bands of suckers cease, scattered suckers, placed mostly two by two, extend for some distance along the proximal part of the arms. The suckers of the tentacular arms are so small that their form cannot be seen with the naked eye; they are deep, cup-shaped, with a small circular aperture, supported by a horny rim, which is often armed with two or three sharp teeth on one side (fig. 2 *c*).

Color of body and arms, so far as preserved in alcohol, deep brownish orange; on the upper side of the back and caudal fin the color is better preserved, and shows small, occellated, circular spots of orange-brown, with an inner circle of whitish and a central spot of purplish brown. Similar spots also exist on the head and arms, and also on the lower side of the body, where the color is best preserved.

A considerable amount of a bright orange oily fluid, insoluble in alcohol, exuded from the viscera. Examined by means of the spectroscope this fluid absorbed part of the green, all of the blue, and most of the violet rays. The stomach contained fragments of small crustacea. The pen is pale yellow, thin, and slender anteriorly, with two sublateral costæ, and narrow delicate margins outside the costæ; in the middle it becomes still thinner and narrower, with the margin inrolled; farther back the margins become much wider and then unite together ventrally, forming a long, hollow, conical portion, extending to the acute posterior tip; this portion is not so broad as deep, and has a slight dorsal keel and a ventral groove.

Measurements. (*In millimeters*).

Sex	Male.	Male.
Total length to end of sessile arms	137	232
Head and body combined	59	122
Length of body	46	99
Length of caudal fin, from origin	30	60
Breadth of caudal fin	42	75
Breadth of body	15	23
Length of dorsal arms	24	45
Length of second pair of arms	33	60
Length of third pair of arms	34	60
Length of ventral arms	80	112
Length of tentacular arms	.....	312
Breadth of dorsal arms, at base	3	4
Breadth of ventral arms	6	7
Breadth of tentacular arms	2	4
Diameter of eye	7.5	9
Length of pen	.....	198
Breadth of pen anteriorly	.....	2.25
Breadth of pen posteriorly	.....	2.50
Depth of pen posteriorly	.....	4.50

Specimens examined.

No.	Locality.	Fathoms.	When received.	Name of vessel.	Received from—	Specimen.	
						No.	Sex.
24	ccexxv. N. L. 33° 25′ 20″; W. Lg. 76°	647	1880	Blake ...	Mus. Comp. Zool..	1	♂
25	ccexxviii. N. L. 34° 28′ 25″; W. Lg. 75° 22′ 50″.	1,632	1880	...do	.....do	1	♂

Calliteuthis Verrill.

Amer. Journ. Sci., vol. xx, p. 393, for Nov., 1880 (published Oct. 25); Proc. Nat. Mus., vol. iii, p. 362, 1880; Trans. Conn. Acad., vol. v, p. 295, Jan., 1881; Bulletin Mus. Comp. Zool., viii, p. 111, March, 1881.

Body short, tapering to a small, free tip. Fins small, united behind the tip of the body. Pen with a short narrow shaft and thin lanceolate blade, as in *Loligo*. Siphon not sunken in a furrow, but united to the head by a pair of dorsal bands; an internal valve. Mantle united to the sides of the siphon by simple, linear, longitudinal, lateral ridges, corresponding with connective cartilages on the sides of the siphon, which are long-ovate, with a raised margin all around. A dorsal, elongated, connective cartilage on the neck, opposite the pen. Arms long, not webbed. Suckers in two rows, largest on the middle of the lateral and dorsal arms; horny rings of suckers smooth on most of the suckers, simply dentate on the distal ones. Eyes large, with rounded openings and thin, free lids. No nuchal frills or crests. Buccal membrane simple, sack-like, with seven connective bridles. Internal anatomy of the female similar to that of *Ommastrephes*. Oviducts and nidamental glands symmetrically developed on the two sides. Oviducts opening in front of the bases of the gills, the openings simple, long, narrow, oblique. Two long, ligulate nidamental glands, with acute anterior ends, lie side by side and a little apart, on the middle of the visceral mass, behind and over the heart; each of these consists of two halves, folded together, and covered on the inner surface with fine transverse laminæ; they open along the outer edge.

This genus may, perhaps, belong to the *Chiroteuthidæ*.

Calliteuthis reversa Verrill.

Amer. Journ. Sci., vol. xx, p. 393, Nov., 1880; Proc. Nat. Mus., vol. iii, p. 362, Dec., 1880; Trans. Conn. Acad., vol. v, p. 295, pl. 46, figs. 1–1 *b*, Jan., 1881; Bulletin Mus. Comp. Zool., vol. viii, p. 112, pl. vii, figs. 1–1 *b*, 1881.

Plate XXII, figures 1–1 *c*.

Body rather short, tapering backward, subacute posteriorly; front edge of mantle advancing somewhat in the middle and forming an obtuse angle; considerably emarginate beneath. Caudal fin small, short, thin, each half nearly semicircular, attached subdorsally, posterior end

emarginate and free from the tip of the body, but not extending much beyond it. Head large, flattened above. Eyes very large, with simple, thin, free, circular lids, without any sinus. Openings of the ears behind the eyes, minute, with a small, erect, clavate, fleshy process of the skin. Arms long, tapering, equal to the length of head and body combined; the lateral pairs are equal; the dorsal and ventral nearly equal, somewhat shorter than laterals; suckers deeper than broad, well rounded, laterally attached by slender pedicels; horny rings with smooth, circular, thin edges, except on the small suckers, toward the tips of the arms, in which the outer edge is divided into a number of small, narrow, blunt teeth. On the ventral arms the suckers are much smaller. Basal web rudimentary; a narrow, thin, simple membrane along each side, outside the suckers. Tentacular arms rather slender, compressed, smooth at base, the ends absent. Color reddish brown. The ventral surface of the body, head, and arms is more ornamented than the dorsal surface, being covered with large, rounded verrucæ, their center or anterior half pale, the border or posterior half dark purplish brown; upper surface of body with much fewer and smaller scattered verrucæ; a circle of the same around the eyes; inner surfaces of sessile arms and buccal membranes chocolate-brown; tentacular arms lighter; suckers pale yellow, with a light brown band. Caudal fin white, translucent. Iris in the preserved specimen, brown. Gills with the free edge brown, and a brown line on the outer edges of all the laminæ

Total length, to end of lateral arms, 133^{mm}; to base of arms, 67^{mm}; mantle, 51^{mm}; of fin, 17^{mm}; breadth of fins, 24^{mm}; of body, 20^{mm}; diameter of eyeball, 16^{mm}; length of dorsal arms, 58^{mm}; of second pair, 67^{mm}; of third pair, 68^{mm}; of ventral pair, 60^{mm}; breadth of dorsal arms at base, 5^{mm}; of lateral, 6^{mm}; diameter of largest suckers, 1.2^{mm}.

Dredged by the steamer "Fish Hawk," of the U. S. Fish Commission, at station 894, about 100 miles south of Newport, R. I., N. lat. 39° 53′, W. long. 70° 58′ 30″, in 365 fathoms.

Family CHIROTEUTHIDÆ Gray (restricted).

Loligopsidæ (*pars*) D'Orb., Céphal. Acétab., p. 320, 1835–1848.
Chiroteuthidæ (*pars*) Gray, Brit. Mus. Catal., Moll., vol. i, p. 42, 1849.

Body small, connective cartilages three, movable. Eyes with free, simple lids, no sinus. Siphon small, with neither internal valve nor dorsal bridle. Nuchal or auditory crests absent. Buccal membrane seven-angled, without suckers. Buccal aquiferous openings six. Sessile arms simple; suckers with horny rings, which are encircled by a groove; web rudimentary. Tentacular arms very long and slender, with a large club; tip with a spoon-shaped organ, opening backward; peduncle with connective suckers and tubercles; club with rows of singular small suckers, having a swollen bulb on the long pedicel. Pen lance-shaped, with a long, narrow shaft.

Chiroteuthis D'Orb. is the best known genus.

Chiroteuthis Bonplandi D'Orb. (?).

Loligopsis Bonplandi Verany, Acad. Turin, ser. ii, vol. i, pl. 5 (specimen without tentacular arms, t. D'Orb.).

Chiroteuthis Bonplandi D'Orbigny, Céphal. Acétab., p. 226 (description compiled from Verany).

Verrill, Bulletin Mus. Comp. Zool., vol. viii, p. 102, pl. 3, figs. 1–1 *b*, 1881; Trans. Conn. Acad., vol. v, p. 299, pl. 47, figs. 1–1 *b*.

Plate XXXII, figures 1–1 *c*.

A detached tentacular arm belonging to a species of *Chiroteuthis* was taken by the United States Coast Survey steamer "Blake," in the summer of 1880, at station ccciii, lat. 41° 34′ 30″, long. 65° 54′ 30″, in 306 fathoms.

The arm is very long and slender, the length being 780^{mm} (or over 30 inches), its diameter being from 1.5^{mm} to 2^{mm}, except near the base, where it is 3^{mm}, and at the terminal club, which is 6^{mm} broad and 54^{mm} long. The arm is white, with purplish specks, and is generally roundish, except at the club; along the greater part of its length there is a row of rather distant sessile suckers, the distance between them being usually from 12^{mm} to 18^{mm}; these suckers are larger than those of the club, and have a nearly flat upper surface and no horny marginal rim is preserved. A row of small, simple, scattered pits, perhaps homologues of these suckers, extends up the back side of the club. These smooth suckers evidently serve to unite the tentacular arms together when used in concert. The club is much stouter than the rest of the arm, convex on both sides, and but little flattened; on each side it is bordered by a well-developed scalloped marginal membrane, supported by a series of transverse, thickened, but flat, tapering, acute, muscular processes, with their ends prolonged beyond the edge of the intermediate membrane, producing a deeply-scalloped border; on the distal half of the club these muscular supports are separated by spaces greater than their breadth, but on the proximal portion they subdivide into two or three parts, which become crowded close together, showing only narrow intervals or merely a groove between them. At the tip of the arm there is a thick, ovate, dark purple, spoon-shaped, hollow organ, about 4^{mm} long, with its opening on the back side of the arm. This so strongly resembles the spoon-shaped organ of the hectocotylized arm of some Octopods as to suggest the possibility of a similar use for sexual purposes. The suckers are crowded in four or more indistinct rows. Their pedicels are long and slender, having beyond the middle a large, dark purple, fluted, swollen portion or bulb, beyond which the pedicel is more slender; the cup of the sucker is small and lateral, with a very oblique, oblong, horny rim, which is not distinctly toothed (fig. 1 *b*); but its extreme outer edge is sometimes slightly beaked and much thickened.

The fleshy border of the suckers is covered with small angular and irregular scales (fig. 1 *c*); its edge is tinged with purple.

This tentacular arm is referred to *C. Bonplandi* only provisionally, for

no perfect specimen of the latter, with the corresponding arms present, has been described. It appears to differ from the tentacular arm of *C. Veranyi* D'Orb., which is the only other species sufficiently described to be recognized as belonging to this genus.

Family HISTIOTEUTHIDÆ, nov.

Loligopsidæ (*pars*) D'Orbig., Céphal. Acétab., p. 320, 1835–1848.
Chiroteuthidæ (*pars*) Gray, Catal. Brit. Mus., Moll., vol. i, p. 42, 1849.

Body small, short, with caudal fins. Mantle united to the neck by three movable cartilages. Siphon with neither dorsal bridle nor internal valve. Head large. Nuchal crests absent. Eyes large, not prominent; lids free and simple; no sinus. Buccal membrane with six smooth lobes; buccal aquiferous openings four. Two brachial openings at the bases of the tentacular arms. Six upper arms united by a very broad web; suckers in two rows; rings convex, with small, oblique apertures. Tentacular arms long, with a well-developed club, bearing large central and small marginal suckers; proximal part of club with connective suckers and tubercles. Pen broad, short, lanceolate, much like that of *Loligo*.

Histioteuthis D'Orbigny, 1839.

Histioteuthis Férussac & D'Orbigny, Histoire Naturelle des Céphalopodes Acétabulifères, p. 226.
Gray, Catal. British Mus., Moll., vol. i, p. 34, 1849 (description after D'Orbigny).

This genus is remarkable for having the six upper sessile arms united together nearly to their tips by a thin, elastic membrane or web. The ventral arms are also united together for a part of their length, and their common web is joined to the great web, in the median line, by a bridle-like membrane. The tentacular arms are very long, and have expanded clubs, with a broad dorsal keel. As in *Architeuthis* and *Sthenoteuthis*, they are furnished with a series of small smooth-rimmed suckers, alternating with tubercles, on the proximal part of the club and adjacent part of the arm, for the purpose of uniting the arms together at will; but in the following species a row of such suckers and tubercles also extends along one side of the club, opposite part of the large central suckers. The large suckers are serrated, and alternate in two rows; two rows of large marginal suckers exist on one side and two rows of much smaller ones on the other. At the extreme tip of the arm there is a cluster of small smooth-edged suckers, as in *Ommastrephes*, *Architeuthis*, &c.

The mouth is surrounded by a broad buccal membrane, with six angles or lobes, but without suckers. The body is relatively short, with short, bilobed caudal fins. The eyes are large, and have distinct lids. The dorsal bone or pen is thin, short, lanceolate, and somewhat quill-shaped, with a long blade.

The species, so far as known, are brilliantly colored, having occellated spots on raised verrucæ, in addition to the ordinary chromatophores of squids.

The two foreign species, hitherto described, are both from the Mediterranean.

Histioteuthis Collinsii Verrill.

Histioteuthis Collinsii Verrill, American Journal of Science, vol. xvii, p. 241, March, 1879; vol. xix, p. 290, pl. 14, April, 1880; Trans. Conn. Acad., vol. v, p. 234, pls. 22, 27, figs. 3, 4, 5, pl. 37, fig. 5, 1880.

Tryon, Manual of Conchology, vol. i, p. 166, 1879 (description copied from the original one).

Plate XXIII, Plate XXIV, figures 3–6.

A large and handsome species, with the broad, thin, dark-brown web extending between and nearly to the ends of the six upper arms. The outer surface of the head and arms is covered with large, slightly raised warts or tubercles, which are dark blue with a whitish center, specked with brown; three rows extend along the ventral arms and two along the others; a circle of these surrounds the eyelids, but the edges of the eyelids are narrowly bordered with dark brown. Color between the warts pale purplish brown, with small, raised dark-brown spots, reddish specks, and white granules; web and inner surface of arms uniform dark reddish or purplish brown; suckers yellowish white, their pedicels specked with brown; tentacular arms light orange-brown. Eyes mutilated; their lids form a large, simple, rounded opening.

Tentacular arms slender, about 2 feet long and expanding near the end into a broad, long-oval, sucker-bearing portion or club (Plate XXIV, fig. 3), which is bordered by a membrane, widest on the upper edge; it ends in a tapering tip, on the back of which there is a thin, crest-like membrane or keel, enlarging proximally to its end, where it forms a rounded lobe. The most expanded portion of the club bears six rows of suckers, with finely serrate horny rings; the two central rows contain much the largest suckers, four or five in each; the more central of these two rows contains four suckers, larger than the rest, and of these the two median are largest; outside of these two median rows are two regular marginal rows of nearly equal, medium-sized, serrate suckers on the upper edge; and along the lower edge of the club there is one row of few similar but smaller ones; outside of these there is an incomplete alternating row of much smaller marginal ones. On the lower edge of the proximal portion of the club, extending from the middle backward, there is a row of four small, smooth-edged, unequal suckers, alternating with rounded, sessile tubercles that fit into corresponding suckers on the other arm; a row of similar but smaller suckers extends for about 6 inches along the inner surface in the median line of the arm, alternating at first singly, and then two by two, with tubercles, and gradually becoming more distant. The end of the arm, beyond

the expanded club, bears minute serrate suckers, at first in six rows, decreasing to two toward the end. The extreme tip bears a small group of minute, smooth-edged suckers. The largest suckers of the club are decidedly constricted below the margin, and then swell out at the basal portion. The edge of the horny rim is divided into very numerous small, incurved, and crowded denticles, nearly equal in length, but part are thickened and obtuse, while the rest are more slender and acute. Diameter of the largest suckers 6.5^{mm}; of the largest in the second row, 5.5^{mm}; of the largest in the lateral rows, 3^{mm} to 4^{mm}; of the largest smooth-rimmed marginal suckers, 2^{mm} to 2.5^{mm}; of the smooth-rimmed suckers of the wrist, 1.5^{mm} to 2^{mm}.

Sessile arms stout, trapezoidal, tapering to slender tips, and bearing two rows of numerous suckers. All the arms on the left side are an inch or more longer than the corresponding right ones. The dorsal and ventral arms of the same side are about equal, and decidedly shorter than the two lateral pairs, which differ but little in length. Web about two-thirds as broad as the length of the arms, uniting the upper three pairs together, and as a narrowing border extending along their sides to the tips. The lower lateral arms have a thin, crest-line membrane on their outer median surface, commencing at the basal fourth and extending nearly to the tips. The ventral arms are united together, toward the base, by a web, which is also joined to the main web, in the median plane. A narrow outer web, arising from the outer angles of the arms, also unites all the arms together for a short distance above their bases.

The suckers (Plate XXIV, figs. 5, *a*, *b*) are all similar in form. The larger ones on the dorsal arms are, perhaps, a little larger than those on the lateral and ventral ones. The largest are subglobular, laterally attached, and gibbous; the aperture is small, usually with three or four flat, blunt, or rounded lobes or denticles on the outer margin, with none on the inner margin. The pedicels of the larger suckers are very stout at base, tapering up to their attachment on the lower side of the sucker, where they are small and slender. The largest suckers of the dorsal arms are 5^{mm} in diameter; their apertures, 2^{mm}; length of pedicels, 4^{mm} to 5^{mm}. The largest suckers on the ventral arms are not so large as those on the others; the largest are 4^{mm} in diameter. Only a few suckers (five or six), and these of very small size and nearly in one row, extend below the level of the ventral web, which is attached along the inner margin, inside the row of suckers. The larger ventral suckers are depressed and oblique, with a very one-sided horny ring, which has a small, oblique aperture, with about three bluntly rounded, slightly prominent lobes or denticles on the outer margin, while the inner margin is smooth.

The membranes about the mouth are arranged nearly as in *Ommastrephes*. The mouth is surrounded externally by a broad, elevated, smooth, dark chocolate-brown buccal membrane or collar, which is prolonged into six angular lobes, corresponding to all the intervals between the arms, except those between the second and third pairs;

this buccal collar is connected to the interbrachial membrane by six membranous bridles, corresponding to the six lobes; on both sides of the dorsal and ventral bridles are large pouches. The beak (Plate XXIV, fig. 4) is immediately surrounded by a thick, fleshy, lobed and wrinkled collar, and outside of this by another less prominent and less wrinkled one.

The exposed parts of the mandibles are black, the inner laminæ bright reddish brown. The beak of the upper mandible is very acute, strongly incurved, with scarcely any distinct notch at the base of the cutting edge, but with a conspicuously-excavated V-shaped area; the anterior edges of the alæ are irregularly and slightly denticulate or crenulate. The lower mandible has a much incurved beak, with the cutting edges decidedly concave, and a very small notch at their bases, but with a broad excavated area along their sides and bases; the anterior edges of the alæ are slightly convex and form a very obtuse angle with the edges of the beak or rostrum; a small, thin tooth exists just beyond the notch; the alæ are broadest near their inner ends; the gular lamina is peculiar in having a prominent, thickened, curved, lateral rib on each side, running to the end of the prolonged and subacute lateral lobes, and another dorsal one, running to the dorsal emargination. Length of upper mandible, 30^{mm}; hight, palatine to frontal, 20^{mm}; hight (or breadth) of palatine, 14^{mm}; tip of beak to end of frontal, 22^{mm}; to base of cutting edge (notch), 7.5^{mm}; notch to inner end of alæ (union with palatine), 7.05 ^{mm}; beak to posterior lateral border of alæ, 13.5^{mm}; transverse breadth across outer side of alæ, 9.5^{mm}. Lower mandible, length, 23^{mm}; inner ends of alæ to mentum, 22.5^{mm}; tip of beak to dorsal border of gular lamina, 17^{mm}; to inner ends of alæ, 18^{mm}; to notch, 8.5^{mm}; breadth of alæ in middle, 8^{mm}; greatest transverse breadth across alæ, 23^{mm}; across anterior edge, at teeth, 7.5^{mm}; notch to union of gular lamina and alæ, 6.5^{mm}; breadth of gular lamina, 12.5^{mm}.

The odontophore is rather short, the dorsal portion not much exceeding the ventral in length; the lateral membrane is broad and thin, its posterior border extending transversely straight across to the dorsal fold, nearly at right angles to the dorsal portion of the odontophore; the dentigerous portion, including a thickened lateral ridge outside the teeth, is light red in color. Length of dorsal portion, from anterior bend, 8.5^{mm}; of ventral portion, 8^{mm}; breadth of dentigerous zone, 3^{mm}.

The median teeth (Plate XXIV, fig. 6, *a*) are short, with a strongly incurved, acute central point, and with small, inconspicuous or rudimentary, blunt, lateral denticles on each side; the inner lateral teeth (*b*) are longer, without a distinct lateral denticle; the two outer rows have simple, rather slender, strongly incurved, acute teeth, the outermost a little longer and more slender. The plates along the border appear to be so closely united as not to be easily separated entire; they form a continuous but slight, narrow ridge, which has an undulated surface. The membrane

lining the palate bears pale yellowish, scattered, stout, not very acute, and but slightly curved teeth, with bases not much enlarged; among these are clusters of small, stony, smoothish granules, often aggregated into masses of considerable size. The gular membrane also bears aggregations of small, smoothish, rounded, and angular granules, with others that are larger, oblong, and oval, smooth, and more or less regularly arranged. The œsophagus is very long and slender, dark colored.

Measurements of Histioteuthis Collinsii.

	Millimeters.	Inches.
Tentacular arms, length	609 and 635	24 and 25
Diameter at base	12.5	.50
Breadth of club, without membrane	17.5	.70
Its membranous border	6.2	.25
Length of club	69	2.75
Length of the slender tip	31	1.25
Of dorsal crest	37	1.50
Length of dorsal arm of left side	355	14
Of 1st lateral (2d pair)	432	17
Of 2d lateral (3d pair)	438	17.25
Of ventral arm	361	14.25
Breadth of lateral arms at base	22.5	.90
Thickness	19	.75
Diameter of eye-opening	22.5	.90
Diameter of head at base of arms	87	3.50
Breadth of web between arms	203 to 254	8 to 10
Diameter of largest suckers of tentacular arms	6.5	.26

Taken from the stomach of *Alepidosaurus ferox*, lat. 42° 49′, long. 62° 57′, off Nova Scotia, by Capt. J. W. Collins and crew of the schooner "Marion," 1879.

All parts back of the eyes are absent; the eyes are mutilated, but the specimen is otherwise in excellent preservation, even the web and suckers being nearly uninjured.

In addition to the original specimen, above described, another specimen, represented by the jaws alone, has been received by the United States Fish Commission from the Gloucester fisheries (lot 843). This was obtained on the Western Bank, off Nova Scotia.

Another beak was dredged by the "Fish Hawk," at station 893, south of Newport, R. I., in 372 fathoms.

These jaws agree well in size and all other characters with those of the original specimen (Plate XXIV, fig. 4).

Family DESMOTEUTHIDÆ Verrill.

Trans. Conn. Acad., vol. v, p. 300, Feb., 1881.

For the reception of the genera *Desmoteuthis* V. and *Taonius* St., as defined below, I established this new family, which had previously been confounded with *Cranchidæ* and *Loligopsidæ*.

Body much elongated, pointed posteriorly; caudal fin narrow, terminal, mantle united to neck by a dorsal and two lateral muscular commissures. Pen lance-shaped, as long as the mantle, with a long, narrow shaft; blade incurved or hooded posteriorly. Œsophagus and intestine very much elongated. Nidamental glands and oviducts large, symmetrical. Eyes large, protuberant; lids free and simple. No auditory crests. Siphon large, with neither internal valve nor dorsal bridle.

Arms with depressed suckers. Tentacular arms with a well-developed club, bearing suckers.

DESMOTEUTHIS Verrill.

Taonius (*pars*) Steenstrup, 1861.
Desmoteuthis Verrill, Trans. Conn. Acad., vol. v, p. 300, Feb., 1881.

Body very long, tapering backward to a long, slender, acute caudal portion. Caudal fin long, narrow, tapering to a long, acute tip. Anterior edge of the mantle united directly to the head, on the dorsal side, by a commissure, so that there is no free edge medially, and the surface is continuous, as in *Sepiola;* the dorsal commissure extends backward and diverges within the mantle; two additional muscular commissures unite the lateral inner surfaces of the mantle to the sides of the siphon. Eyes very large and prominent, with simple circular lids. No aquiferous pores. Siphon large and prominent, with neither valve nor dorsal bridles. Arms small and short, subequal, with a basal web and lateral membranes; suckers smallest on the ventral arms, and urceolate, largest and flatish on the middle of the lateral and dorsal arms, feebly toothed. Pen extending the whole length of the body, very slender and of uniform width for more than half the length, then becoming broad-lanceolate, the terminal portion having the edges involute, forming a long, slender cone, into which the ovary extends. Nidamental glands large, symmetrically developed on the two sides. Gills small, situated in front of the middle of the body.

The genus *Taonius* was proposed by Steenstrup to include this and *T. pavo* (Les. sp.), but he has not, to my knowledge, definitely defined the genus. As *T. pavo* appears to be generically distinct from the present genus, I propose to retain *Taonius*, with *T. pavo* for its type. By many writers *T. pavo* has been placed in *Loligopsis* or *Leachia*. Steenstrup himself formerly referred *D. hyperborea* to *Leachia*. By Tryon both have been referred back to *Loligopsis*.

Loligopsis, as defined by D'Orbigny, in 1839, included *T. pavo*, as well as the type of *Leachia*, but he referred Lamarck's original type of *Loligopsis* to the genus, as amended by him, only with doubt.

It seems desirable, therefore, to explain this confusion, so far as possible.

Loligopsis Lamarck,* 1812 and 1822, was based only on an imperfect figure, made by Péron, of a small oceanic squid which had lost its tentacular arms. The supposed character of having *eight arms* was, for him, the only basis for the genus, no others being mentioned. The species (*L. Peronii*) was, however, described very briefly as a small squid with eight equal arms and two posterior, distinct caudal fins, and it was compared to *Sepiola*. It has apparently not been rediscovered by later writers, unless *L. chrysophthalma* D'Orb. be the same species, which is quite possible. The latter, as figured, is a small, *short-bodied species*,

*Extr. de Cours de Zool., p. 133, 1812 (t. D'Orb.); Animaux sans Vert., vol. vii, p. 659, 1822.

with distinct, separate, small caudal fins, which are free from the end of the body; its mantle-edge is also represented as free dorsally. This evidently is a generic type distinct from *Taonius* and *Desmoteuthis*. Indeed, it probably will be found not to belong to the same *family*, when actually studied. Therefore, it seems necessary to allow the name *Loligopsis* to remain connected with such small, short-bodied species, for which alone it was originally used. The genus, in its original sense, cannot yet be regarded as fully established.

Leachia Lesueur, 1821* (=*Perothis* (Esch.) Rathke, 1835), was also based on an *imperfect figure* of a small Pacific Ocean squid, which had likewise lost its tentacular arms. The only generic character given was, as in Lamarck's case, the presence of only eight arms—a purely fictitious character. The type of this genus was *Leachia cyclura* Les. It has a more elongated body, slender posteriorly, with a more or less rounded caudal fin, the two sides of the fin completely united together and to the posterior end of the body. The third pair of arms is much larger than the others. The anterior dorsal edge of the mantle is represented as *free* in all the figures, but, according to D'Orbigny, there is an internal dorsal commissure, and also two lateral ones. The visceral anatomy of one species of this group (*L. guttata* Grant), which D'Orbigny refers, probably correctly,† to the original *L. cyclura*, is pretty well known, and is widely different from that of *Desmoteuthis* (see Plate XXIV, fig. 1), as well as from that of *Taonius*, so far as the latter is known.

There can be no doubt whatever as to the generic distinctness of *Leachia*, if the *anatomy* be taken into account. (See the figures of Grant and D'Orbigny.)

Taonius Steenstrup, 1861 (type *T. pavo*). This differs from the two preceding genera in its more elongated form, narrow caudal fin, &c. From *Leachia* and *Desmoteuthis* it differs in the form of its pen. The dorsal edge of the mantle is represented and described as free by D'Orbigny. The anatomical characters are not known.

Desmoteuthis hyperborea Verrill.

Leachia hyperborea Steenstrup, Kongelige Danske Vidensk. Selsk. Skrifter, 5 r., vol. iv, p. 200, 1856 (sep. copies, p. 16).

Taonius hyperboreus Steenst., Oversigt Kgl. Danske Vidensk. Selsk., Forhandlinger, 1861, p. 83.

Verrill, Amer. Journ. Sci., vol. xvii, p. 243, 1879; vol. xix, p. 290, 1880.

Loligopsis hyperboreus Tryon, op. cit., p. 162 (inaccurate translation, after Steenstrup).

Desmoteuthis hyperborea Verrill, Trans. Conn. Acad., vol. v, p. 302, pl. 27, figs. 1, 2, pl. 29, fig. 1, Feb., 1881.

Plate XXIV, figures 1–3. Plate XXV, figures 1, 2 (anatomy).

♀. Body very long, tapering gradually backward, and ending in a

* Journal Philad. Acad., vol. ii, p. 89, pl. 2.

† Tryon criticizes this determination because Lesueur "describes and figures a smooth species," while *L. guttata* has two rows of curious tubercles *on the ventral side.* But as Lesueur only *described a figure of the dorsal surface,* his objection to this identification is absurd.

long, slender, acute tail; mantle soft and flabby, with a capacious branchial cavity; anterior dorsal edge advancing somewhat in the middle and directly united to the head, so as to leave no free edge medially, by a rather wide commissural band, the sides of which diverge as they extend backward within the mantle. Caudal fin long, narrow, lanceolate, narrowly acuminate to a very long, acute tip; the anterior insertions are wide apart, and the anterior border is rounded. Head short and small, exclusive of the eyes, which are very large, globular, and prominent, their lower sides in contact beneath the head; openings round, looking somewhat downward; pupils large and round; lids thin and simple. Siphon very large and prominent, extending forward between the eyes, but without a special groove; dorsal surface firmly united to the head by a thick commissure, leaving about half the length free; opening large, without any valve.

Arms comparatively small and short, none of them complete in our specimen except those of the third and fourth pairs, which are nearly equal in length, the ventral ones a little the shortest and most slender; the dorsal and second pairs of arms have lost their distal portions, but the parts of the dorsal arms remaining correspond in size with the ventral ones, and those of the second pair with the third pair. The arms are all united together by a thin, delicate basal web, which extends up some distance between the arms (farthest between the dorsal pair), and then runs along the sides of the arms, as broad, thin marginal membranes, to the tips. Suckers of the ventral arms smaller and different in form from those of the others, all of them being urceolate, with narrow apertures, surrounded by a slightly enlarged border, and having small horny rings, with the edge entire, or nearly so, on the proximal suckers, but on the smaller ones, toward the tip, with a few broad, blunt teeth on the outer edge. On the dorsal and lateral arms the basal suckers are ventricose and urceolate, like those of the ventral arms, but along the middle portion of these arms the suckers become much larger, and have a broad, shallow form, with wide apertures and expanded bases; the horny rings of these larger suckers are divided into several broad, bluntly rounded teeth on the outer edge; toward the tips of the arms the smaller suckers again become deeper, with more contracted apertures, and with a few more prominent denticles on the rings.

Outer buccal membrane with seven obtuse angles, and united to the arms by seven bridles, or commissures, of which the upper one is double. Exposed part of the beak black; mandibles very acute, strongly incurved.

Pen very thin and narrow, and of nearly uniform width (4^{mm}) for more than half its length; at about four-sevenths of its length from the anterior end it gradually expands laterally into a broad, very thin, lanceolate form, becoming, opposite the broadest part of the fin, 30^{mm} wide, with very delicate lateral expansions and with a pretty strong dorsal keel; farther back it tapers and is very acuminate, the lateral margins

becoming involute, so as to form a very long, slender, acute, terminal, hollow cone, extending to the tip of the tail. The anterior end is obtusely rounded and thin; a short distance from the anterior end there are two thin lateral processes, directed forward, to which the commissural muscles were attached (Plate XXV, figure 2).

Color of entire body, siphon, and caudal fin dark brown, thickly covered with large, roundish, unequal spots of darker brown and paler brown, intermixed; head, eyes, arms, and web dark brownish purple, with crowded chromatophores; suckers yellowish.

Total length, to end of lateral arms, 16 inches; to dorsal edge of mantle, 13 inches; length of head, 1 inch; diameter of eye, 1 inch; length of caudal fin, 5 inches; its breadth, 1.80 inches.*

Measurements (in millimeters).

	A ♀.	B.
Length to tip of lateral arms	410	.....
Length to base of arms	354	.....
Length to base of mantle, above	330	210
Length of caudal fin	127	103
Breadth of caudal fin	46	18
Diameter of body	57	.....
Diameter of eye	25	26
Length of 3d pair of arms	56	63
Length of ventral arms	52	38
Diameter of largest suckers of lateral arms	3	5
Length of pen	330	.....
Of anterior linear portion	180	.....
Of posterior lanceolate part	150	.....
Breadth of anterior portion	3	.....
Breadth of lanceolate part	30	.....

A is the specimen described above; B is the specimen described by Steenstrup from Greenland. The latter had the dorsal arms 40^{mm} long; 2d pair 50^{mm}; tentacular arms 68 and 70^{mm}, respectively. The larger size of the suckers of the latter may indicate that it was a male.

Our specimen was taken near the northern edge of the Gulf Stream, West long. 55°, by Thomas Lee, of the schooner "Wm. H. Oaks," January, 1879, and by him presented to the U. S. Fish Commission. Baffin's Bay, Northern Greenland (Steenstrup).

Notes on the visceral anatomy.

Plate XXV, figure 1.

The only specimen of this species obtained had the internal organs considerably injured, but the anatomy is so unlike that of the more common genera of squids that it seemed to me desirable to figure such parts as are preserved.

This specimen is a female, and the large nidamental glands (x', xx, xx') are symmetrically developed on the two sides; these are swollen, voluminous organs, composed of great numbers of internal lamellæ; the anterior ones (x') occupy the region around and in front of the

* Some of these measurements are slightly larger than those originally given. This is due to the fact that the specimen has been kept, since first received, in somewhat weaker alcohol, and has become more relaxed in consequence of this, combined with repeated handling.

bases of the gills, extending forward and having an oblique, oblong opening (*op*, *op'*) on the outside of the anterior ends; the posterior ones (*xx*, *xx'*) are behind the gills and cover the branchial auricles; the oblique, slit-like opening is on the outer side of the posterior ends; the gland on the left side (*xx'*) was mutilated; the posterior vena cava in front of *r'* passes through the center of the posterior gland (*xx*). The ovary (*ov*) is a very long organ, attached to the stomach (*s*) and to the sides of its long cœcal appendage; it extends far backward to near the tip of the tail, occupying the concavity of the pen (*p*); it consists of great numbers of small clustered folicles; connected with its anterior end, and attached to the stomach, there is a convoluted tube, probably an oviduct, not well shown in the figure; connected with and opening into the intestine, near its origin, there is a firm, roundish organ, with internal lamellæ, perhaps a part of the stomach or gizzard (fig. 1, *s*). The stomach was much mutilated, so that its form could not be certainly made out. What appears to have been a portion of the stomach, or else the anterior part of the cœcal appendage (*s*,*s*), had a cavity lined with numerous longitudinal folds; from this a very long, saccular, cœcal appendage, longitudinally plicated within (*s''*), runs back, along the ovary, into the caudal cavity of the pen. The œsophagus had been destroyed. The intestine (*l*, *h*) is very long and slender, internally longitudinally plicated, and externally covered along nearly its whole length, on one side, by close groups of small glandular folicles (*l*, *l*); the terminal portion is closely attached to the ventral edge of the small, smooth, firm, compressed, oblong-ovate liver (*i*), and its free, stout anal end (*h*) is provided with two slender, tapering cirri. The ink-sac (*i'*) is small, pyriform, between the front part of the liver and the rectum.

The gills (*g*, *g*) are small and short, situated far forward, and connected to the ventricle of the heart (*H*) by long afferent vessels (*bo*); the branchial auricles (*au*, *au*) are rounded, without terminal capsules; the ventricle of the heart (*H*), as preserved, is small and four-lobed, the largest lobe directed forward and passing into the anterior aorta. The condition of the specimen did not permit the circulation to be much studied. The two large, fusiform, cellular organs (*r'*, *r'*) are probably renal in nature; their interior is filled with large, irregular cavities or lacunæ, which appear to be connected with the posterior venæ cavæ (*vc''*).

TAONIUS Steenstrup (restricted).

Loligo (*pars*) Lesueur, Journ. Philad. Acad., vol. ii, p. 96, 1821.
Loligopsis (*pars*) D'Orbigny, Céph. Acétab., p. 320 (*non* Lamarck).
Gray (*pars*), Catal. Moll. Brit. Mus., vol. i, p. 39, 1849.
Taonius (*pars*) Steenstrup, Oversigt Kgl. Danske Vidensk. Selsk. Forh., 1861, pp. 70, 85.
Taonius Verrill, Trans. Conn. Acad., vol. v, p. 306, Feb., 1881.

This genus seems to bear about the same relation to *Desmoteuthis* that *Rossia* does to *Sepiola*. Its relations with *Loligopsis* and *Leachia* have already been discussed (pp. 301, 302). The body is short-pointed pos-

teriorly. The caudal fin is long-cordate, but not slender-pointed. The pen is lance-shaped, the anterior portion being long, narrow, of nearly uniform width; posterior end broad-lanceolate, short-pointed posteriorly, and, according to the figures, without a cone at the tip. The anterior dorsal edge of the mantle is represented as free externally, but there is a dorsal commissure within the mantle-cavity, and a lateral one on each side. Arms short, subequal; suckers flat, denticulate, those of the tentacles with sharp, incurved teeth. Eyes large, globular, prominent; lids free and simple.

Siphon with neither valve nor dorsal bridle. No external ears, nuchal crests, nor cephalic aquiferous pores.

Taonius pavo Steenstrup.

Loligo pavo Lesueur, Journal Acad. Nat. Science Philad., vol. ii, p. 96, with a plate, 1821.

Loligopsis pavo Férussac & D'Orb., Céph. Acétab., p. 321, Calmars, pl. 6, figs. 1–4 (after Lesueur); Loligopsis, pl. 4, figs. 1–8 (details, original).

Binney, in Gould's Invert. Mass., ed. 2, p. 309 (but *not* the figure, pl. 26).

Verrill, Amer. Journ. Sci., vol. xix, p. 290, 1880.

Tryon, Amer. Mar. Conch, p. 9, pl. 1, fig. 3 (after Lesueur); Man. Conch., vol. i, p. 163, pl. 68, fig. 252, pl. 69, fig. 253, 1879 (descr. from Gray, figures from Lesueur and D'Orb.).

Taonius pavo Steenst., Oversigt Kgl. Danske Vidensk. Selsk. Forh., 1861, pp. 70, 85.

Verrill, Trans. Conn. Acad., vol. v, p. 306, Feb., 1881.

This species differs externally from the preceding in having a much shorter, obtuse, oblong-cordate fin, instead of a long, slender, pointed one, and by its very distinct coloration. According to Lesueur, the general color is carmine-brown, the mantle, head, and arms "covered on every part with very large ocellations, which are connected together by smaller intermediate ones." Length of mantle, 10 inches.

Sandy Bay, Mass. (Lesueur). Newfoundland (Steenstrup). Off Madeira (D'Orbigny).

No instance of the occurrence of this oceanic species on the New England coast has been recorded since the original specimen was described by Lesueur in 1821. The circumstances connected with the history of his specimen are such as to render it not improbable that some interchange of labels had occurred in his case. Therefore, the New England habitat for this species needs confirmation.

Lesueur's statement (loc. cit., p. 94) is that when at Sandy Bay, Mass. (on Cape Ann), in 1816, he saw a "great number" of squids ("*Loligos*") that had been taken by the fishermen for bait, and that "the beautiful color with which they were ornamented induced me to take a drawing of one immediately, but not then having leisure to complete it, I took a specimen with me to finish the drawing at my leisure. But recently [in 1821], upon comparing this specimen with my drawing, I was much surprised to perceive that I had brought with me a very distinct species from that which I had observed [*O. illecebrosus*]. I mention this circum-

stance to explain the cause of the brevity of the following description [of *O. illecebrosus*] taken from my drawing." The drawing was also inaccurate for the same reason.

MYOPSIDÆ D'Orbigny.

Eyes without regular lids, the integument of the head extending continuously over the eye, and becoming transparent over the pupil of the eye. In some genera (*Rossia*, &c.) there is a thickened fold of skin below the eye, constituting a sort of false lower eyelid. Pupil crescent-shaped. A small mucous pore in front of the anterior edge of the eye, connected with the orbital cavity.

Family LOLIGINIDÆ.

Teuthidæ (*pars*) Owen, Proc. Zool. Soc. London, p. 285, 1847.
Loligidæ D'Orbigny, Céph. Acétab., p. 297, 1848.
Loligidæ (*pars*) Gray, Catal. Moll. Brit. Mus., vol. i, p. 66, 1849.
Loliginidæ (*pars*) H. & A. Adams, Genera, Moll., vol. i, p. 35.

Body more or less elongated, cylindro-conical. Fins elongated, united and acute posteriorly, sometimes extending the whole length of the body. Pen large, extending the whole length of the mantle, with an acute, short, pen-like anterior shaft, and a broader, thin, lanceolate blade. Connective cartilages of the mantle three, movable. Eyes without a thickened false lid. Siphon provided with an internal valve, and attached to the head by a dorsal bridle. Nuchal crests about the ears well-developed. Tentacular club large, with four rows of denticulated suckers on the middle portion. Horny rings of the suckers encircled externally by a raised median ridge.

On our coast this family is represented only by the genus *Loligo*. At Bermuda and in the West Indies a species of *Sepioteuthis* occurs, which will probably hereafter be found on our southern coast. In the latter the fins extend along the whole length of the mantle.

LOLIGO Lamarck, 1779.

Loligo (*pars*) Lamarck, Syst. Anim. sans Vert., p. 60, 1801.
Pteroteuthis (subgenus) Blainville, Man. Malac., p. 367, 1825.
Loligo (restricted) D'Orbigny, Céph. Acétab., p. 305, 1848.
Verrill, Trans. Conn. Acad., vol. v, p. 307, Feb., 1881.

Body elongated, tapering to a point behind; anterior edge of mantle free dorsally, and prolonged into a lobe, covering the end of the pen. Caudal fin posterior, elongated-rhomboidal, united to the sides of the body to the posterior tip. Mantle connected to the neck by a dorsal and two lateral connective cartilages; lateral cartilages of the mantle simple longitudinal ridges; corresponding cartilages, on the base of the siphon, irregularly ovate, with a median groove. Pen as long as the mantle, anteriorly narrow, with a central keel and two lateral ridges; posteriorly broad, thin, lanceolate, concave, but not involute. Head rather large; eyes without lids, covered with transparent skin, pupil

crescent-shaped, encroached upon dorsally by the iris; a small mucous pore in front of the eyes; behind the eyes, on each side, there is an oblique transverse and two longitudinal, erect, thin crests, in relation with the ears. Siphon situated in a shallow groove, united to the head by a pair of dorsal bridles, and furnished with a large internal valve. Six buccal aquiferous pores, and a pair of branchial pores, one on each side, between the bases of the third and fourth pairs of arms. Buccal membrane with seven elongated points, covered on their inner surfaces with small suckers; in the female with a special organ (Plate XXVI, fig. 4, *s*), below the beak, on the ventral side, for the attachment of the spermatophores.

Sessile arms angular; basal web rudimentary or none; suckers in two rows, oblique, deep cup-shaped; horny rings toothed on the broad side, and surrounded with a median ridge. Male with one of the ventral arms (usually the left) hectocotylized, near the tip, by an enlargement of the bases of the pedicels of the suckers and a decrease or disappearance of the cups. Tentacular arms long and strong, with an expanded club, provided with marginal membranes and a dorsal keel; suckers, on the widest part, usually in four rows, those in the two central rows larger, broad-urceolate; smaller ones cover the proximal and distal portions; no connective suckers on the club or along the arm. Sucker-rings surrounded externally by a raised band.

Oviduct large, developed only on the left side. Nidamental glands large in front of heart. Eggs in fusiform, gelatinous capsules, attached by one end, and usually radially united into large clusters.

Loligo Pealei Lesueur (*typical form*).

Loligo Pealei Lesueur, Journ. Acad. Nat. Sci. Philad., vol. ii, p. 92, pl. 8, 1821.

Loligo Pealii Blainville, Dict. Sci. Nat., vol. xxvii, p. 144, 1823.

Férussac & D'Orbigny, Céph. Acétab., p. 311, Calmars, pl. 11, figs. 1–5, pl. 20, figs. 17–21 (details).

Gray (*Pealii*), Catal. Moll. Brit. Mus., vol. i, p. 71, 1849.

Binney, in Gould's Invert. Mass., ed. 2, p. 514, pl. 25, figs. 339, 340 (figure erroneously referred to *O. Bartramii*).

Verrill (*Pealii*), Report on Invert. Vineyard Sd., pp. 440, 635 (sep. copies, p. 341), pl. 20, figs. 102–105, 1877.

Tryon (*Pealii*), Man. Conch., vol. i, p. 142, pl. 51, figs. 133–140 (figs. from Fér. & D'Orb. and Dekay).

Verrill, Amer. Journ. Sci., vol. iii, p. 281, 1872; Amer. Naturalist, vol. viii, p. 170 (habits); Amer. Journ. Sci., vol. xix, p. 292, 1880 (descr.) (*Pealei*); Trans. Conn. Acad., vol. v, pp. 308–340, pl. 29, figs. 1–4, pl. 37, figs. 1–3, pl. 39, fig. 4, pl. 40, pl. 45, figs. 3, 4, 1881.

Brooks (*Pealii*), Develop. of the squid, in Anniver. Mem. Boston Soc. Nat. Hist. pl. 1–3, March, 1881 (embryology).

Loligo punctata Dekay, Nat. Hist. N. Y., Mollusca, p. 3, pl. 1, fig. 1, 1843 (young).

Binney, in Gould's Invert. Mass., p. 513 (after Dekay).

Tryon, Amer. Mar. Conch., p. 14, pl. 43, figs. 10, 11 (after Dekay).

Variety *borealis* Verrill.

Loligo Pealei var. *borealis* Verrill, Amer. Journ. Sci., vol. xix, p. 292, 1880.

Loligo Pealei Lesueur—(Continued).

Variety *pallida* Verrill.

Loligo pallida Verrill, Rep. Invert. Viney. Sd., in Rep. U. S. Com. Fish and Fisheries, vol. i, p. 635 [341], pl. 20, figs. 101, 101 *a*, 1874.

Tryon, Man. Conch., p. 143, pl. 52, figs. 141, 142 (descr. and figs. copied from preceding).

Verrill, Amer. Journ. Sci., vol. xix, p. 292, 1880.

Loligo Pealei var. *pallida* Verrill, Trans. Conn. Acad., vol. v, p. 317, pl. 28, figs. 1–6, 1881.

Plate XXVI, figures 1–4. Plate XXVII, figures 1–4 (pens). Plate XXVIII, figures 1–9, Plate XXIX (anatomy ♂). Plate XXX (young). Plate XXXI, figures 1–3. Plate XXXII, figure 2 (anatomy ♀).

Body rather elongated, more or less stout, according to state of distention or contraction,* tapering backward to a moderately acute posterior end, more acute in the male than in the female. Caudal fin long-rhomboidal, with the outer angles very obtusely rounded, and varying, according to age, in the ratio of its length to its breadth, and greatly, also, in the proportion that its length bears to that of the mantle.† The length of the caudal fin, in proportion to that of the body (mantle), although variable, normally increases with age, even after sexual maturity. In this species, with specimens having the mantle from 100^{mm} to 125^{mm} long, the ratio of the fin to the mantle usually varies from 1 : 1.80 to 1 : 1.90; with the mantle 150^{mm} to 175^{mm} long, the ratio usually becomes 1 : 1.65 to 1 : 1.75; in the largest specimens, with the mantle 260^{mm} to 400^{mm} long, the ratio varies from 1 : 1.50 to 1 : 1.65, rarely becoming 1 : 1.75. The ratio of the breadth of the caudal fin to the length of the mantle, in the larger male specimens, ranges from 1 : 2.12 to 1 : 2.40, varying considerably according to the mode of preservation; in the larger females it varies from 1 : 1.70 to 1 : 2.12.

The anterior ventral edge of the mantle recedes, in front of the siphon, in a broad curve, leaving an obtuse angle at either side, opposite the lateral cartilages; from these angles it again recedes, on the sides, in a concave line, and then projects considerably forward, forming a prominent median dorsal lobe, which gradually tapers from the base, and

* The mantle, when the gill-cavity is distended with water, has a larger size than when the water is expelled by the contraction of its walls, which is usually the condition in which specimens die. Moreover, when the large stomach is distended with food, and when the ovary is distended, in the breeding season, with eggs, the form is stouter than usual.

† This variation is largely independent of sex, and is due partly to the ordinary changes during growth, partly to the condition of the muscular tissues at the time of death, and partly to the effects of the alcohol in which they have been preserved. These latter causes, in the case of preserved specimens, more or less obscure the effects of growth in causing the proportions to change.

The most marked effect of strong alcohol is to reduce the diameter of the body and the breadth of the caudal fin to a proportionally far greater extent than it does the length of the mantle and fin. Therefore, with specimens that have been preserved in too strong alcohol, the females resemble the males in form, and the males often look like a different species, on account of their unnaturally long and narrow fins and very slender bodies.

then rather suddenly narrows to a point, over the end of the pen; the point, when in its normal position, reaches as far forward as the posterior border of the eye, or even beyond it. Dorsal connective cartilage long, tapering backwards, with a very prominent, broad dorsal keel; the anterior end is free and shaped like the end of the pen. Siphon large, rounded anteriorly, with a broad, bilabiate opening; lateral cartilages (Plate XXIX, fig. 1, *f*) long and narrow, subacute anteriorly, posterior end with a thin, rounded outer lobe; median groove narrow. The connective cartilages of the mantle (fig. 1, *f'*) are simple longitudinal ridges, fading out gradually posteriorly. Head moderately large, usually narrower than the mantle, smaller in the male than in the female; eyes large; nuchal crests (fig. 1, *b*) above the ear, formed by longer upper, and shorter inferior, oblique, longitudinal membranes, the two united by a doubly curved or V-shaped membrane, having its angle directed forward, the whole having a rude W-shaped form.

Arms large, stout, the three upper pairs successively longer; the ventral ones a little shorter than the third pair, and a little longer than the second pair. All the arms have narrow, thin marginal membranes, strengthened by strong transverse muscular ridges. The first and second pairs of arms are trapezoidal at base; third pair stouter, compressed, with a keel on the middle of the outer side. Suckers in two regular rows on all the arms, deep, very oblique, largest on the lateral arms; those on the ventral arms are smaller, but otherwise similar. Horny rings yellowish or brownish (white when fresh), strong; on the larger proximal suckers the outer or higher side is divided into about six broad, flattened, incurved teeth, which are blunt, subtruncate, and sometimes even emarginate at tip, remainder of margin nearly even; the smaller suckers, toward the tips of the arms, have the teeth longer, much more slender, and more acute.

The tentacular arms (Plate XXVI, fig. 2) with fresh specimens, in full extension, may reach back nearly to the end of the body; with preserved specimens they seldom extend beyond the middle of the caudal fin; they are rather slender, compressed, with a narrow, thin membranous keel along the outer edge, becoming wider at the club; on the distal half of the club it is much wider and runs a little obliquely along the back part of the upper side, where it is usually folded down against the side, its inner surface being whitish. The club is rather broad and thick, with a wide, scalloped marginal membrane along each edge; these membranes are strengthened by transverse muscular ridges, which commence between the large central suckers and fork at the pedicels of the marginal ones. Along the center of the club there are two alternating rows of large, broad, depressed suckers, about seven in each, with a few smaller ones, of the same series, at both ends; along each edge, alternating with the large suckers, there is a row of smaller and more oblique marginal suckers, about half as large. The proximal part of the club bears only a few small denticulated suckers; the distal part bears a

large number of small, sharply denticulated, pedicelled suckers, crowdedly arranged in four rows; close to the tips of the arms about twenty of the small suckers have smooth rims and very short pedicels, but are still in four rows. The large suckers vary greatly in relative size, according to age, sex, season, and locality (Plate XXXI, figs. 1, 2, 3); they are a little higher on one side than on the other, with a broad aperture, surrounded by a horny marginal ring, which is divided all around into sharp, unequal teeth, which are larger on the outer side (Plate XXVIII, figs 3, 4, *c*, *c*); usually one minute sharp tooth stands between two larger ones, and these sets of three stand between still larger and less acute ones; the horny ring is surrounded by a wide, thick, soft marginal membrane; below the border a groove surrounds the sucker, and below this there is a basal swelling, equaling or exceeding the margin in diameter. The smaller marginal suckers (Plate XXVIII, figs. 9, 9 *a*) have the aperture more oblique and the horny ring much wider on the outer side, with its outer sharp marginal teeth longer and more incurved; usually these have the teeth alternately larger and smaller.

The outer buccal membrane (Plate XXVI, fig. 4) is large, thin, with seven prominent, elongated, acute angles, all of which have a cluster of about ten to fifteen small pedicelled suckers, in two rows, on the inner surface (*a*, *b*, *c*, *d*). These suckers have horny rings, denticulated on one side. In the female there is a special thickened organ (*s*) in the form of a horseshoe on the inner ventral surface of the buccal membrane. This in the breeding season serves for the attachment of the spermatophores by the male.

The muscular pharynx (fig. 4, *e*, *f*) containing the jaws can be protruded its whole length. The inner buccal membrane (*f*) or sheath inclosing the beak (*m*) has a prominent, thickened, radially wrinkled and puckered anterior margin. On the ventral side the pharynx bears, externally, two thin chitinous plates, not connected with the jaws. The points and exposed edges of the beak are hard and black, becoming dark reddish brown farther back; the alæ and gular and palatine laminæ are thin and pale yellowish or light amber-color, in alcoholic specimens. The upper mandible (Plate XXVIII, figs. 5, 5 *a*, var. *pallida*) has a sharp, strongly incurved point; cutting edge regularly curved, with a triangular notch at its base, followed by a prominent triangular tooth on the alar edge, beyond which the edge is nearly straight, but recedes somewhat. Lower mandible with a sharply incurved point and sinuous cutting edges, which have a slight tooth below the middle and only a slight rounded notch at base, which passes gradually into the very oblique and receding alar edge. The bilobed palate is covered with a chitinous membrane, which bears transparent, small, sharp, recurved denticles.

Radula with pale amber-colored teeth and thin transparent borders. The median teeth (Plate XXVIII, figs. 6–8) are broad, with a long, acute median denticle, and a shorter, curved, and less acute lateral one, on each side; the inner lateral teeth (*b*) are short, strongly incurved, with a

longer, acute central denticle and a smaller outer one, and with the inner angle of the base slightly prominent; the next to the outer lateral teeth (fig. 6, *c*) are much longer, broad, tapered, curved, acute; the outer teeth (fig. 6, *d*) are longer, more slender, more curved, triquetral, and very acute, with a large basal lobe. A row of thin, distinct, roundish scales (fig. 6, *e*) forms a border outside the teeth.

The pen (Plate XXVII, figs. 1–4) is thin, translucent, pale yellowish in fresh specimens, but brownish or amber-color in alcoholic specimens. It has a short, narrow, anterior shaft and a long, very thin, lanceolate blade, which is concave beneath, especially posteriorly, for the edges curve downward, but are not involute; the posterior tip is acute, a little thickened, and slightly curved downward, so that the posterior end is shaped something like the forward part of an inverted shallow canoe; the cavity at the extreme tip is slightly decked over in large specimens. In the male (fig. 4) the pen is relatively longer and the blade narrower than in the female. The extreme anterior end is thin and flexible, and rather sharply and abruptly pointed, being shaped like a pen; the shaft is rather stiff, with a strong, regularly rounded keel, convex above and concave beneath; outside of the keel the marginal portion curves outward and then upward, so that its convex surface is below, and the edge slightly turns up. The shaft, with its central keel and marginal ridges, extends to the posterior tip of the pen, decreasing regularly in width beyond the commencement of the blade. The blade is at first very narrow, and gradually increases in width; it is marked by numerous slightly thickened ridges, which diverge from the central line as they extend backward; the edges are very thin.

In the larger males the proportion of the greatest breadth of the blade to the total length of the pen varies from 1:7.50 to 1:9.36. In the females it varies from 1:5.60 to 1:6.10.

The following description of the colors was made from a freshly caught adult male specimen (1 G), taken in New Haven Harbor, May 18, 1880.

Upper surfaces of the body, head, and caudal fin thickly covered with rather large chromatophores, which are mostly rounded or nearly circular, except along the middle of the back, where they are more crowded and darker, and mostly have a long-elliptical form (perhaps accidental).

The chromatophores, when expanded, are light red to dark lake-red, varying to purplish red and pink; when contracted to small points, they become brownish purple.

On the head, behind the middle of the eyes, and toward the margin of the caudal fin, the spots are smaller and less numerous, the intervening bluish white ground-color showing more largely. Over most of the dorsal surface the chromatophores are arranged more or less evidently in circular groups; usually the central chromatophore is a large, round, dark-purplish spot; this is surrounded by a circular space of whitish ground-color, and by a circle of roundish chromatophores, mostly of different shades of lake-red and pink, and a deeper lying circle of pale

canary-yellow ones. On the lower side they are so thinly scattered that they leave much of the translucent bluish white ground-color visible between them; along the median ventral line the spots are more numerous, producing a distinct median stripe. The caudal fin is clear bluish white beneath, and very translucent, becoming almost transparent near the margin.

Exposed part of the siphon similar to the ventral surface of the body, but with the spots more sparse, and mostly disappearing near the margin and at the base; lower side of the head, in front of the eyes, sparsely spotted. Outer and upper sides of the upper arms and outer surfaces of the ventral pair similarly, but somewhat more densely, specked; both sides of the ventral arms and lower sides of the lateral arms pinkish white and unspotted. Tentacular arms pale translucent, bluish white, with the outer surface, except at base, rather thinly specked with small purplish chromatophores; the inner surface and upper side of the tip and the suckers are translucent white; rings of suckers white.

On the inner surface of the dorsal and lateral arms, between the suckers, there are a few large chromatophores, and a double row of them runs out obliquely on the muscular thickenings of the marginal membrane, alternating with the suckers, on each side; suckers pure translucent, bluish white (becoming yellow or brown in alcohol).

The pupils of the eyes are deep bluish black; on the upper side they are encroached upon by a sinuous downward extension of the iris, which is silvery or pearly white, with brilliant, green, opalescent reflections at the upper margin.

Sexual differences.

The sexes differ to a considerable extent in proportions. If we compare specimens of equal length, the female will have the body relatively stouter and less tapered posteriorly than the male; the head is decidedly larger;* the arms are longer; the suckers are usually distinctly larger, especially those of the tentacular arms. But if we compare specimens having the head and arms of equal size, the male will be found to have a decidedly longer, more slender, and more tapered body, and a somewhat longer and narrower fin. (See Table B, for comparative proportions.)

In the adult male the circumference of the head to the mantle-length usually varies from 1:2.55 to 3.45, averaging about 1:3.10; in the female from 1:1.75 to 1:2.45, averaging about 1:2.25.

The ratio of the breadth of the fin to the mantle-length, in the male, varies from 1:2.12 to 1:2.45, averaging about 1:2.25; in the female, from 1:1.70 to 1:2.12, averaging about 1:1.90.

*Some of the nominal European species of *Loligo*, that have been based on the smaller size of the head, arms, and suckers, are probably only the males of the common species. The sexual variations in this genus have apparently been very imperfectly understood by European writers generally.

The ratio of the diameter of the largest tentacular suckers to the mantle-length varies, in the male, from 1:50 to 1:90, averaging about 1:65; in the female it varies from 1:36 to 1:54, averaging about 1:45.

The proportion of the length of the dorsal arms to the mantle-length, in the male, averages about 1:3.50; in the female about 1:2.75.

The pen of the female is relatively broader and shorter than that of the male (see Table A).

The best and most positive external characters for distinguishing the sexes are the hectocotylized condition of the left ventral arm of the male, near the tip (Plate XXVI, figs. 3, 3 *a*), and the presence, in the female, of a horseshoe-shaped sucker, or place for attachment of the spermatophores, on the inner buccal membrane, below the beak (fig. 4, *s*,) These characters, however, are not present in the very young individuals, and in those with the mantle two or three inches long they appear only in a very rudimentary state.*

A.—*Sexual variations in the pen (measurements in inches).*

	♂ P.	♂ 9 V.	♂ 10 V.	♂ W.	♀ E.	♀ EE.	♀ 17 V.	♀ An.
Length of pen	10.50	10.20	9.55	8.50	7.75	7.65	7.55	7.50
Length of shaft	1.40	2.10	2.20	2.00	2.00	1.10	1.50	1.50
Length of blade	9.10	8.10	7.35	6.50	5.75	6.55	6.05	6.00
Breadth of shaft	.50	.35	.40	.40	.15	.38	.35	.35
Breadth of blade	1.40	1.15	1.02	.98	1.00	1.35	1.25	1.30
PROPORTIONS.								
Greatest breadth to length 1:	7.50	8.86	9.36	8.67	7.75	5.66	6.04	5.76

The specimen marked An is from Cape Ann, Mass. (var. *borealis*); that marked ♀ E is var. *pallida*, from Astoria, N. Y.; the rest are from Vineyard Sound, Mass.

The adult males have the left ventral arm conspicuously hectocotylized (Plate XXVI, figs. 3, 3 *a*) by an alteration and enlargement of the sucker-pedicels and a decrease in the size of the cups of the suckers, some of which usually disappear entirely, especially in the outer row. The modification commences at about the 18th to 20th sucker, by the swelling of the bases of the pedicels; on succeeding suckers this rapidly becomes more marked, and the swollen bases of the pedicels become more elongated and gradually become compressed transversely, while the size of the cups rapidly decreases till at about the 28th to 30th they are very minute and rest at the summits of the large, flattened, acute-triangular supports; from the 30th to 35th the cups usually become mere rudiments, or disappear in large males; beyond this the cups again grow larger and the pedicels decrease in size, till the small suckers become normal on the tip of the arm. About twenty-five to thirty of

* Professor Steenstrup formerly advanced the opinion that the males of *Octopus* and other genera of Cephalopods were provided with the hectocotylized arm from the first, but this we have not found to be the case. The hectocotylized condition of the arm in *Loligo* is developed in proportion to the development of the internal sexual organs, and is first distinctly noticeable in the larger of the young ones taken in autumn, and in the spring in the young ones that have survived their first winter.

the suckers of the outer row are thus modified in the larger males. Of the inner row a somewhat smaller number of suckers show distinct alteration, and these are less extensively altered; their pedicels are swollen and their cups reduced, but not to so great an extent, and usually none of the cups are entirely absent.

In young males, with the mantle about 70mm to 90mm (young of the previous year, or perhaps of the first year, when three to five months old), these modifications of the suckers began to appear, at first very indistinctly, by a slight enlargement of the bases of the pedicels and a scarcely noticeable decrease in the size of the cups. In specimens with the mantle 100mm to 130mm long (probably young of the previous year, nine months to a year old) the modification of the suckers, though much less marked than in the adults, is sufficiently distinct, the pedicels having become distinctly longer and stouter, while the cups are evidently reduced in size, but none of them are abortive in such specimens.

Loligo Pealei var. **borealis** Verrill.

Plate XXVII, figure 1 (pen). Plate XXXII, figure 2 (anatomy).

Since describing this variety, I have had opportunities to examine a much larger series of specimens from Cape Ann. These show very plainly that this form passes by intermediate gradations into the typical form, so that it cannot be considered as anything more than a local or geographical variety. The differences in the proportion of the fin to the mantle, noticed in the original specimens, do not hold good with a larger series. The only varietal character of much importance is the relatively smaller suckers, and this is much less marked in most of the later examples than in the former ones, and is a character that varies greatly in the specimens from every locality.*

In the original specimens the 'pen' (Plate XXVII, fig. 1), while having the general form of that of *L. Pealei*, tapers more gradually anteriorly, and has a narrower, more tapered, sharper, and stiffer anterior tip. The variations in proportion are sufficiently indicated by the measurements given in Tables A, B, and C, in which those specimens designated as 2 G to 5 G were measured while fresh. The one marked An ♀ is from the lot originally described as variety *borealis*, and illustrates the abnormally small size of the suckers.

Loligo Pealei var. **pallida** Verrill.

Plate XXVIII, figures 1–7. Plate XXIX, figure 1 (anatomy).

This geographical variety or subspecies is distinguished from the typical form chiefly by its shorter and stouter body in both sexes, its broader and larger caudal fin, and the larger size of the suckers, especially those of the tentacular club.

The caudal fin is broad-rhomboidal, often as broad as long, or even

* Probably those with abnormally small tentacular suckers are instances in which the arms, the clubs, or the suckers have been lost and afterwards reproduced, as explained below.

broader than long in adult specimens. The ratio of the breadth of the fin to the mantle-length in the larger specimens (with mantle 150^{mm} to 225^{mm} long) is, in the males, from 1 : 1.75 to 1 : 2.00, while in *L. Pealei*, of corresponding size, the ratio is 1 : 2.15 to 1 : 2.30; in the females of var. *pallida*, of similar size, the ratio varies from 1 : 1.45 to 1 : 1.75 (see Tables F, G). Tentacular arms long and slender, varying in length according to the amount of contraction, in extension longer than the body, the club or portion that bears suckers forming about one-third the whole length. In a few males the larger suckers on the middle of this portion are not so large as the largest on the lateral arms, but usually they are twice as large. In some females the principal suckers of the tentacular arms are very much larger than in others, and considerably exceed those of the males of equal length; they form two alternating rows, of eight to ten each, along the middle of the club; external to them there is a row of smaller suckers alternating with them on each side; the suckers toward the tips are very numerous, small, and crowded in four rows; at the tip there is a group of about twenty minute, smooth-edged suckers, in four rows. Outside of the suckers, on each side, there is a broad marginal membrane, having the edges scalloped, and strengthened between the scallops by strong transverse muscular ridges; another membranous fold runs along the back side, expanding into a broad membranous keel or crest near the end. The arms of the ventral pair are intermediate in length between those of the second and third pairs.

Ground-color of the body, head, arms, and fins pale, translucent yellowish white; the upper surface is covered with pale brown, unequal, circular spots, which are not crowded, having spaces of whitish between them; the spots are more sparse on the head and arms, but somewhat clustered above the eyes; entire ventral surface pale, with small, distant, brownish, circular spots, which are nearly obsolete on the siphon and arms. The general appearance of the animal, when fresh, is unusually pale and gelatinous. The pen is broad, quill-shaped, translucent, and amber-colored.

A medium-sized male specimen, recently preserved in alcohol, measured 145^{mm} from the base of the dorsal arms to the posterior end of the body; length of body, 120^{mm}; length of caudal fin, 70^{mm}; breadth of fin, 75^{mm}; length of first pair of arms, 42^{mm}; of second pair, 50^{mm}; of third, 60^{mm}; of ventral pair, 53^{mm}; of tentacular arms, 150^{mm}. (For other measurements, see Tables B to E.)

Astoria, Long Island, Nov. 16 and Dec. 7, 1871 (Robert Benner).

This form has been received hitherto only from the western part of Long Island Sound, where it is abundant with the schools of menhaden, on which it feeds.

Reproduction of lost parts.

I have observed in this species, as well as in *Ommastrephes illecebrosus*, numerous instances in which some of the suckers have been torn off and

afterwards reproduced. In such examples new suckers of various sizes, from those that are very minute up to those that are but little smaller than the normal ones, can often be found scattered among the latter on the same individual. It seems to me possible that some of the specimens having the suckers on the tentacular arms unusually small may have reproduced all those suckers, or, still more likely, the entire arm.

I have seen specimens of this species, and also of *O. illecebrosus*, which, after having lost the tips, or even the distal half of one or more of the sessile arms, have more or less completely reproduced the lost parts.* In such cases the restored portion is often more slender and has smaller suckers than the normal arms, and where the old part joins the new there is often an abrupt change in size. Probably this difference would wholly disappear after a longer time.

An unquestionable and most remarkable example of the reproduction of several entire arms occurs in a small specimen taken off Newport, R. I., August, 1880. This has the mantle 70^{mm} long; dorsal arms, 22^{mm}; 3d pair of arms, 30^{mm}. The three upper pairs of arms are perfectly normal, but both the tentacular and both the ventral arms have evidently been entirely lost and then reproduced from the very base. These four arms are now nearly perfect in form, but are scarcely half their normal size on the left side, and still smaller on the right side. The left tentacular arm is only 24^{mm} long, and very slender, but it has the normal proportion of club, and the suckers, though well formed, are diminutive, and those of the two median rows are scarcely larger than the lateral ones, and delicately denticulated. The right tentacular arm is less than half as long (12^{mm}), being of about the same length as the restored ventral one of the same side; it is also very slender, and its suckers very minute and soft, in four equal rows. The right ventral arm is only 14^{mm} long; the left one 15^{mm} long; both are provided with very small but otherwise normal suckers.

In another specimen from Vineyard Sound, a female, with the mantle about 150^{mm} long, one of the tentacular arms had lost its club, but the wound had healed and a new club was in process of formation. This new club is represented by a small, tapering, acute process, starting out obliquely from the stump, and having a sigmoid curvature; its inner surface is covered with very minute suckers. The other arms are normal.

Eggs and young.

The eggs are contained in many elongated, fusiform, gelatinous capsules (Plate XXX, fig. 7) which are attached in clusters by one end to sea-weeds or some other common support; from the point of attachment they radiate in all directions. These clusters are often six or eight inches in diameter, containing hundreds of capsules, which are mostly from two

* Perhaps the *Dosidicus Eschrichtii* Steenstrup is only an *Ommastrephes* or *Sthenoteuthis* which had lost and partially reproduced the tips of all the arms. At any rate, no sufficient characters have been given to distinguish it generically.

to three inches long and filled with numerous eggs, the number varying from 20, or less, up to about 200. The transparent eggs are arranged, in the well-formed capsules, in six or more rows, and are so closely crowded that they touch each other and often take polygonal forms, especially when preserved.

How many of these capsules are deposited by one female is very uncertain. Probably several females are concerned in the formation of the larger clusters. The eggs are mostly laid in June and July, but many are laid in August, and some even in September. By the 11th of June, in the vicinity of New Haven, many of these eggs contain embryos in advanced stages of development (Plate XXX, figs. 1, 2). The embryos, before hatching, can swim around inside the eggs.

These embryos are very beautiful objects to observe under the microscope.

Even at this early period some of the chromatophores are already developed in the mantle and arms, and during life, if examined under the microscope, these orange and purple vesicles can be seen to contract and expand rapidly and change colors, as in the adult, but the phenomena can be far more clearly seen in these embryos owing to the greater transparency of the skin. In the young the chromatophores are very regularly and symmetrically arranged on the arms, head, and mantle. At this stage of development the eyes are brown. In these embryos a remnant of the yolk-sac (*y*) appears to protrude from the mouth, but it is really connected with the space around the mouth and pharynx, and into this it is eventually absorbed.

The more advanced of the embryos were capable of swimming about, when removed from the eggs, by means of the jets of water from the siphon (*s*), which is developed at an earlier stage. The arms (*a'*-*a''''*) are then short, blunt, very unequal, with few minute suckers; the dorsal arms are very small, while those of the 2d and 3d pairs are successively longer, and have distinct suckers; the tentacular arms (*a'''*) are longer and larger than any of the others, and have larger suckers, which already, in some examples, can be seen to form four rows, but in this stage the peduncular part of these arms is short; the ventral arms (*a''''*) are about as long as the 2d pair, and bear several suckers. The mantle (*m*) is short, and the caudal fins (*f*) are very small, short, lateral, and separately attached to each side of the blunt posterior end of the body, thus recalling their adult condition in *Rossia*. The eyes (*e*) are large and prominent; the rudimentary beak (*d*) and odontophore (*l*) are distinctly visible. The two otoliths (*o*) are very distinctly visible, as highly refracting ovate bodies, above the basal part of the siphon, one on each side. The ink-sac (*i*), attached to the rectum (*t*), is conspicuous on account of its dark color; the gills (*g*) are provided with a small number of transverse processes; the heart (*h*) and the branchial auricles (*h' h'*) are easily seen while they continue to pulsate. The pen exists only in a rudimentary condition, as a thin cartilage.

During July and August the young (figs. 3–5), from less than a quarter

of an inch to an inch or more in length, swim free at the surface, and may often be taken in immense quantities with towing nets. They were particularly abundant in the summers of 1871 and 1873, in Vineyard Sound.

These young squids are devoured in inconceivable numbers by fishes of many kinds, and also by the adult squids of the same species, and by the larger jelly-fishes, and many other marine animals. The larger sizes, and even the adults, are also greedily devoured by blue-fish, black-bass, striped-bass, weak-fish, mackerel, cod, and many other kinds of fishes. Therefore, these "squids" are really of great importance as food for our most valuable market fishes. They are extensively used as bait by the fishermen.

Rate of growth.

I am not aware that any definite information has hitherto been published as to the rate of growth or length of life of any of our Cephalopods. By some writers it has been stated that the squids are all annual, but this seems to be a mere assumption, without any evidence for its basis.

Therefore, I have, for several years past, preserved large numbers of specimens of the young of *Loligo Pealei*, collected at different seasons and localities, in order to ascertain, if possible, the rate of growth and the size acquired during the first season, at least. One of the following tables (I) shows some of the data thus obtained.

There is considerable difficulty in ascertaining the age of these squids, owing to the fact that the spawning season extends through the whole summer, so that the young ones hatched early in June are as large by September as those that hatch in September are in the following spring. Owing to the same cause, most of the large lots of young squids taken in midsummer include various sizes, from those just hatched up to those that are two or three inches long. They are often mixed with some of those of the previous year, considerably larger than the rest. Earlier in the season (in May and the first part of June), before the first-laid eggs begin to hatch, the youngest specimens taken (60^{mm} to 100^{mm} long) are presumed to belong to the later broods of the previous autumn, while those somewhat larger are believed to be from earlier broods of the previous summer, and to represent the growth of one year very nearly.

Taking these principles as a guide, I have arrived at the following conclusions from the data collected:

1. The young squids begin to hatch at least as early as the second week in June, on the southern coast of New England, and continue to hatch till the middle of September, and perhaps later.

2. By the second week in July, the first hatched of the June squids have grown to the size in which the body (or mantle) is 30^{mm} to 48^{mm} long; but these are associated with others that are younger, of all sizes down to those just hatched. They begin to show a disposition to go in "schools" composed of individuals of somewhat similar sizes.

3. By the second week in August, the largest June squids have be-

come 50mm to 68mm in length of body, and the later broods are 5mm to 30mm long. As before, with these sizes occur others of all ages down to those just hatched. It should be observed, however, that in those of our tabulated lots taken by the trawl the very small sizes are absent, because they pass freely through the coarse meshes of the net.

4. By the second week in September, the June squids have the mantle 60mm to 82mm long. All the grades of smaller ones still abound. A few larger specimens, taken the last of August, and in September, 84mm to 110mm long, may belong to the June brood, but they may belong to those of the previous autumn.

5. In the first week of November, the larger young squids taken had acquired a mantle-length of 79mm to 85mm, but these are probably not the largest that might be found. Younger ones, probably hatched in September and October, 8mm to 20mm in length of body, occurred in vast numbers November 1, 1874. The specimens taken November 16, off Chesapeake Bay, having the mantle 40mm to 70mm long, probably belong to the schools hatched in the previous summer.

6. In May and June the smallest squids taken, and believed to be those hatched in the previous September or October, have the mantle 62mm to 100mm long. With these there are others of larger sizes, up to 152mm to 188mm, and connected with the smaller ones by intermediate sizes. All these are believed to belong to the various broods of the previous season. In these the sexual organs begin to increase in size and the external sexual characters begin to appear. The males are of somewhat greater length than the females of the same age.

7. In July, mingled with the young of the season, in some lots, but more often in separate schools, we take young squids having the mantle 75mm to 100mm long. These we can connect by intermediate sizes with those of the previous year taken in June. I regard these as somewhat less than a year old.

8. Beyond the first year it becomes very difficult to determine the age with certainty, for those of the first season begin, even in the autumn, to overlap in their sizes those of the previous year.

9. It is probable that those specimens which are taken in large quantities, while in breeding condition, during the latter part of May and in June, having the mantle 175mm to 225mm long in the females and 200mm to 275mm long in the males, are two years old.

10. It is probable that the largest individuals taken, with the mantle 300mm to 425mm long, are at least three years, and perhaps, in some cases, four years old. The very large specimens generally occur only in small schools and are mostly males. The females that occur with these very large males are often of much smaller size, and may be a year younger than their mates.

11. When squids of very different sizes occur together in a school, it generally happens that the larger ones are engaged in devouring the smaller ones, as the contents of their stomachs clearly show. Therefore,

it is probable that those of similar age keep together in schools for mutual safety.

12. Among the adult specimens of var. *pallida*, taken November 16 and December 7, at Astoria, there are several young ones, from 75^{mm} to 120^{mm} in length, with rudimentary reproductive organs. These may, perhaps, be the young of the year, hatched in June.

Distribution.

This species is found along the whole coast, from South Carolina to Massachusetts Bay.

It is the *common squid* from Cape Hatteras to Cape Cod. In Long Island Sound and Vineyard Sound it is very abundant, and is taken in large numbers in the fish-pounds and seines, and used to a large extent for bait. It is comparatively scarce, though not rare, north of Cape Cod. The young were trawled by us in many localities in Massachusetts Bay, in 1878. Large specimens were taken in the pounds at Provincetown, Mass., August, 1879. It was taken in considerable quantities, in breeding condition, in the fish-pounds at Cape Ann, near Gloucester, Mass., May, 1880 (var. *borealis*). It has not been observed north of Cape Ann. Its southern limit is not known to me, but it appears to have been found on the coast of South Carolina.

In depth, it has occurred from low-water mark to fifty fathoms. The eggs have often been taken by us in the trawl, in great abundance, at many localities along the southern shores of New England, in five to twenty-five fathoms.

It is known to be a very important element in the food-supply of the blue-fish, tautog, sea-bass, striped-bass, weak-fish, king-fish, and many other of our larger market fishes.

In the Gulf of Mexicó this species appears to be replaced by another species (*Loligo Gahi* D'Orbigny). Of this we have several specimens, collected on the west coast of Florida, at Egmont Key, near Tampa Bay, by Col. E. Jewett and Mr. W. T. Coons. This species is closely allied to *L. Pealei*, but has a more slender form, with the caudal fin shorter and narrower in proportion to the length of the mantle. The pen has a shorter and broader shaft, and a narrower and more oblong blade, which has parallel, thickened, and darker-colored portions between the midrib and margins (Plate XXVII, fig. 5). The tentacular suckers have their horny rings more coarsely and equally toothed, there being only a partial alternation of larger and smaller teeth.

Along our southern coast, from Delaware Bay to Florida, a much shorter and relatively stouter species (*Loligo brevis* Blainv.) occurs, which might be mistaken by a careless observer for the present species. In addition to its shorter body, it has very different large tentacular suckers, with the teeth on the horny rim coarser and all of similar form and size. Its pen is also shorter and relatively broader, and different in structure (Plate XXXI, figs. 4–6).

B.—*Table to show sexual variations (measurements in inches).*

Loligo Pealei (♂ and ♀).	♂ 1 G.	♂ 4 V.	♂ 6 V.	♂ 5 V.	♂ *a'*.	♂ 9 V.	♂ 8 V.	♂ 10 V.	♀ 13 V.	♀ 1 V.	♀ 12 V.	♀ 2 V.	♀ 11 V.	♀ 5 G.	♀ An.	♀ 17 V.
Length to dorsal mantle-edge	12.00	11.70	11.50	11.40	11.00	10.30	10.00	9.55	10.00	9.40	8.62	8.30	8.25	8.00	7.30	7.75
Length to base of dorsal arms	13.80	13.00	12.50	12.50	12.00	11.50	10.90	10.60	11.40	10.50	9.75	9.50	9.75	9.35	8.20	9.25
Length of dorsal arms	3.50	3.15	3.10	3.30	3.25	3.40	2.80	2.70	3.60	3.40	2.82	3.30	3.15	3.10	.....	2.80
Length of caudal fin	7.90	7.40	7.00	7.10	7.00	6.20	6.10	5.30	6.35	6.20	5.50	5.10	4.75	4.80	4.50	4.80
Breadth of caudal fin	5.00	4.90	5.00	4.90	5.00	4.80	4.70	4.15	4.75	4.60	4.50	4.80	4.60	4.10	4.00	4.35
Breadth between insertions	1.70	1.10	1.20	1.30	1.50	1.12	1.00	.95	1.50	1.30	.37	1.40	1.30	1.50	1.15	1.03
Breadth of body	.....	1.75	1.90	1.70	1.80	.....	1.70	1.10	1.90	1.85	1.70	2.00	1.75	.....	1.20	1.45
Circumference of body	6.00	4.90	5.50	5.30	5.70	5.50	4.90	4.90	5.75	5.50	5.40	5.50	5.15	4.70	.....	4.85
Breadth of head at eyes	1.50	1.50	1.30	1.40	1.50	1.42	1.20	1.18	1.60	1.50	1.58	1.40	1.55	1.40	1.40	1.30
Circumference of head in front of eyes	.....	3.70	3.40	3.50	4.30	3.50	2.90	2.30	4.25	4.75	3.80	.....	3.55	.....	.....	3.15
Diameter of largest tentacular suckers	.18	.19	.16	.18	.22	.20	.11	.11	.23	.20	.19	.21	.19	.15	.08	.15
Diameter of largest of 3d pair of arms	.11	.12	.12	.12	.11	.11	.08	.11	.15	.13	.13	.16	.12	.11	.06	.10
Length of pen	.....	.....	.....	.....	.....	10.20	.....	9.55	.....	.....	.....	.....	.....	.....	.....	7.55
Breadth of pen	.....	.....	.....	.....	.....	1.15	.....	1.09	.....	.....	.....	.....	.....	.....	.....	1.25
PROPORTIONS.																
Fin-length to mantle-length .....1 :	1.51	1.58	1.64	1.60	1.57	1.66	1.63	1.79	1.57	1.51	1.56	1.60	1.73	1.66	1.62	1.61
Fin-breadth to mantle-length.....1 :	2.40	2.38	2.30	2.32	2.20	2.14	2.12	2.28	2.10	2.04	1.91	1.72	1.79	1.95	1.82	1.79
Breadth to length of fin .....1 :	1.58	1.51	1.40	1.44	1.40	1.29	1.29	1.27	1.34	1.34	1.22	1.06	1.03	1.17	1.12	1.10
Circum. of body to mantle-length....1 :	2.00	2.38	2.09	2.15	1.92	1.89	2.04	1.93	1.74	1.70	1.59	1.50	1.60	1.70	.....	1.60
Circum. of head to mantle-length....1 :	.....	3.11	3.38	3.25	2.55	2.94	3.44	4.13	2.35	1.98	2.26	.....	2.32	.....	.....	2.46
Diam. large tent. suckers to length..1 :	66.66	61.04	71.87	63.33	50.00	51.50	90.90	86.36	43.50	47.00	45.36	39.52	43.42	53.33	91.25	51.66
Length of dorsal arms to length. ....1 :	3.43	3.71	3.70	3.45	3.38	3.01	3.57	3.51	2.78	2.76	3.05	2.51	2.61	2.58	.....	2.77

The specimens in this table were selected from those that are best preserved. 1 G is from New Haven, measured while fresh; 1 V to 17 V are from Vineyard Sound, recently preserved and in good condition; *a'* is from Noank, Conn.; 5 G is from Cape Ann, Mass., measured before preservation; An is a specimen from Cape Ann; the latter and 8 V and 10 V have abnormally small suckers.

In the following table, C, A 1, is the typical form from Cape Cod, the largest specimen seen; An, *g'*, 2 G to 5 G, = var. *borealis*, from Cape Ann, Mass.; *a'*, *b'*, from Noank, Conn., typical; 6 V, from Vineyard Sound, Mass.; *c'*, typical, from New Haven. Those marked 1 G to 5 G were measured while fresh; the rest, after preservation in alcohol.

C.—*Table illustrating variations due to growth, sex, locality, and state of preservation (measurements in inches).*

Loligo Pealei (♂ and ♀), typical form and var. borealis.	♂ A 1.	♂ 1 G.	♂ a'.	♂ c'.	♂ 6 V.	♂ 3 G.	♂ 2 G.	♂ b'.	♂ 4 G.	♀ 5 G.	♀ g'.	♀ An.
Tail to tip of dorsal arms	20.75	17.30	15.20	15.75	15.50	15.20	14.70	14.60	13.10	12.20	9.75	10.20
Tail to tip of 2d pair of arms	21.25	17.70	15.50	16.00	16.00	16.00	15.10	14.80	13.70	12.60	10.05	10.50
Tail to tip of 3d pair of arms	21.75	18.00	16.00	15.70	16.50	16.30	15.80	15.30	.....	13.40	10.50	10.85
Tail to tip of 4th pair of arms	21.05	17.40	15.30	16.00	15.75	16.00	15.10	15.10	14.10	12.70	10.00	10.50
Tail to tip of tentacular arms	24.50	23.00	17.50	20.00	20.50	20.50	19.00	16.90	13.20	15.00	12.50	13.50
Tail to base of dorsal arms	17.25	13.80	12.00	12.75	12.50	12.30	11.90	.90	10.10	9.35	8.00	8.20
Tail to center of eye	.25	12.60	11.20	12.00	11.70	11.75	11.00	10.70	9.50	8.75	7.20	7.50
Tail to mantle-edge, above	16.25	12.00	11.00	11.00	11.50	11.00	10.50	10.60	8.90	8.00	7.20	7.30
Tail to mantle-edge, below	15.00	11.00	10.25	.....	10.50	10.25	9.75	9.75	.....	7.30	6.55	6.70
Tail to insertion of fin	9.80	7.90	7.00	7.00	7.00	6.90	6.50	6.60	5.40	4.80	4.35	4.50
Tail to outer angle of fin	7.00	5.50	4.75	5.00	.....	4.80	4.40	4.50	3.75	3.50	3.15	3.30
Breadth of fin	6.85	5.00	5.00	5.00	5.00	4.90	4.50	4.80	4.30	4.10	3.80	4.10
Between insertions	2.10	1.70	1.50	1.20	1.20	1.20	1.30	1.48	1.40	1.50	1.20	1.15
Outer angle to insertions	4.60	3.25	3.40	3.00	.....	3.50	3.20	3.25	2.75	2.70	2.25	2.50
Circumference of body	7.20	6.00	5.70	.....	.....	4.40	4.75	5.30	4.10	4.20	4.25	4.80
Breadth of head at eyes	1.75	1.50	1.50	1.35	1.30	1.30	1.30	1.30	1.40	1.40	1.20	1.40
Breadth of siphon at cartilages	1.30	1.15	1.18	.98	.....	.....	1.05	1.10	1.95	.....	.80	.....
Aperture of siphon	.45	.35	.40	.40	.....	.....	.35	.40	.30	.....	.....	.....
Length of dorsal arms	3.70	3.50	3.25	3.00	3.10	3.25	2.90	3.10	3.00	3.10	2.00	2.20
Length of 2d pair of arms	4.20	4.10	3.50	3.20	3.40	3.50	3.30	3.35	3.50	3.30	2.30	2.50
Length of 3d pair of arms	4.40	4.30	4.00	3.35	3.90	3.75	3.80	3.80	3.90	4.10	2.60	2.85
Length of 4th pair, from base	4.10	3.80	3.35	3.25	3.40	3.60	3.40	3.30	3.30	3.60	2.40	2.70
Length of tentacular arms	7.10	9.25	5.25	7.00	7.25	8.00	7.00	5.50	7.50	8.50	4.40	6.10
Length of tentacular club	2.90	2.80	2.60	2.00	2.40	2.60	2.50	2.55	2.50	2.50	1.50	1.85
Breadth of tentacular club	.90	.40	.75	.40	.50	.40	.35	.60	.40	.40	.35	.30
Breadth of dorsal arms	.35	.30	.31	.28	.24	.....	.20	.27	.....	.....	.20	.23
Breadth of 2d pair of arms	.50	.35	.33	.30	.34	.....	.30	.37	.....	.....	.30	.33
Breadth of 3d pair of arms	.50	.40	.45	.41	.35	.....	.33	.43	.....	.....	.27	.30
Breadth of 4th pair of arms	.40	.35	.35	.32	.35	.....	.32	.30	.....	.....	.28	.28
Breadth of tentacular arm	.30	.15	.20	.20	.17	.....	.12	.20	.....	.....	.18	.15
Diameter of eye (external)	1.20	1.10	1.00	.....	.....	.80	.80	1.00	.65	.65	.....	.....
Largest on tentacular arms	.25	.18	.22	.....	.16	.17	.15	.20	.19	.15	.12	.12
Largest on dorsal arms	.13	.08	.11	.....	.10	.09	.09	.10	.....	.10	.07	.....
Largest on 2d pair arms	.15	.11	.13	.....	.11	.11	.10	.12	.....	.11	.10	.....
Largest on 3d pair arms	.15	.11	.14	.....	.12	.11	.11	.13	.10	.11	.10	.10
Largest on 4th pair arms	.12	.08	.10	.....	.08	.08	.07	.09	.06	.08	.06	.....
PROPORTIONS.												
Fin-length to mantle 1:	1.65	1.51	1.57	1.57	1.64	1.59	1.61	1.60	1.64	1.66	1.65	1.62
Fin-breadth to mantle-length 1:	2.37	2.40	2.20	2.20	2.30	2.24	2.33	2.20	2.06	1.95	1.89	1.78
Fin-breadth to fin-length 1:	1.43	1.58	1.40	1.40	1.40	1.40	1.44	1.37	1.25	1.17	1.14	1.09
Dorsal arm to mantle 1:	4.39	3.42	3.38	3.66	3.70	3.38	3.60	3.38	2.96	2.58	3.60	3.31
Circumference of body to length 1:	2.25	2.00	1.92	.....	.....	2.50	2.20	2.00	2.17	1.90	1.69	1.52
Diameter of tentacular suckers to mantle-length 1:	65.00	66.66	50.00	.....	71.87	64.70	70.00	53.00	46.84	52.33	60.00	60.83

D.—*Table illustrating variations in the males, due mostly to age and mode of preservation (measurements in inches).*

Loligo Pealei (♂).	X.	Y.	Z.	R.	Q.	B.	E.	P.	D.	S.	G.	*oo.*	H.	J.	F.	*k.*	O.
Tail to end of longest sessile arms	16.15	16.70	16.30	15.25	14.81	.....	14.00	14.00	13.65	13.20	12.40	12.80	12.75	12.30	11.80	12.00	10.90
Tail to mantle-edge, above	12.30	12.00	11.30	11.30	10.75	10.50	10.50	10.10	10.00	9.90	9.65	9.15	9.10	9.15	8.90	8.30	8.25
Tail to mantle-edge, below	11.00	10.70	9.35	10.40	9.30	9.75	9.80	9.00	.....	8.80	8.10	8.40	8.20	8.50	8.20	7.25	7.50
Tail to insertion of fin	7.90	7.50	6.70	6.80	6.90	6.60	6.50	6.50	6.35	6.30	5.80	5.70	5.65	5.60	5.50	5.00	4.95
Tail to center of eye	11.60	12.40	12.00	11.50	10.91	.....	10.40	10.30	10.15	9.50	9.20	9.30	9.20	9.20	8.90	8.40	8.00
Tail to base of dorsal arms	11.90	13.10	12.75	12.10	11.50	.....	11.00	11.10	11.00	10.50	9.95	9.70	9.95	9.95	9.60	9.20	8.60
Eye to end of dorsal arms	3.80	3.75	3.20	2.80	3.40	.....	3.40	3.30	2.80	3.40	2.70	3.20	3.15	2.50	2.50	3.10	2.55
Eye to end of 2d pair of arms	4.10	3.95	3.90	3.10	3.55	.....	3.60	3.55	3.15	3.50	2.90	3.40	3.20	2.80	2.80	3.30	2.80
Eye to end of 3d pair of arms	4.55	4.30	4.30	3.70	3.90	.....	4.00	4.10	3.50	3.70	3.20	3.50	3.35	3.11	2.90	3.60	2.90
Eye to end of ventral arms	4.30	4.15	4.00	3.40	3.60	.....	3.50	4.10	3.20	3.40	3.00	3.20	3.30	2.90	2.80	3.20	2.70
Eye to end of tentacular arms	7.80	7.10	7.60	6.25	5.60	.....	5.00	7.00	5.00	5.50	4.40	4.90	4.65	4.75	5.00	6.80	4.70
Breadth of head across eyes	1.65	1.55	1.45	1.65	1.35	1.30	1.50	1.75	1.30	1.30	1.10	1.30	1.20	1.28	1.25	1.10	1.05
Breadth of head in front of eyes	1.45	.....	1.40	1.50	1.35	.....	1.15	1.40	.....	1.20	.80	1.25	1.05	1.05	1.05	1.00	1.00
Breadth of body	1.75	.....	1.70	2.70	1.70	1.75	1.60	1.50	.....	2.60	1.40	1.60	1.30	1.50	1.40	1.50	1.15
Breadth of fins	5.45	5.50	5.60	5.25	5.10	4.50	4.30	5.30	4.20	4.30	4.00	4.20	4.25	4.10	4.25	3.50	3.80
Circumference of body	5.40	5.45	5.00	5.15	4.80	.....	4.75	5.10	4.60	4.80	4.00	4.75	3.85	4.50	4.25	4.50	3.70
Length of tentacular club	3.85	2.60	2.20	2.25	2.00	2.55	1.80	2.20	1.75	5.80	1.60	2.10	1.75	1.70	1.40	1.90	1.30
Length of dorsal arms	.....	2.95	2.65	.....	2.65	.....	2.68	2.85	.....	.....	.....	2.78	.....	2.07	.....	.....	.....
Diameter of largest tentacular suckers	.....	.24	.21	.....	.23	.....	.18	.22	.....	.....	.....	.24	.....	.16	.....	.....	.....
Diameter of largest on 3d pair of arms	.....	.14	.13	.....	.13	.....	.11	.13	.....	.....	.....	.13	.....	.10	.....	.....	.....
PROPORTIONS.																	
Length of fin to mantle-length ....1 :	1.55	1.60	1.68	1.66	1.55	1.50	1.61	1.56	1.67	1.57	1.66	1.60	1.61	1.62	1.61	1.66	1.66
Breadth of fin to mantle-length....1 :	2.25	2.18	2.01	2.15	2.10	2.33	2.44	1.90	2.40	2.30	2.41	2.17	2.14	2.23	2.09	2.37	2.17
Breadth of fin to its length ....1 :	1.44	1.36	1.19	1.30	1.35	1.46	1.51	1.23	1.51	1.46	1.45	1.35	1.32	1.36	1.29	1.42	1.30
Circumference of body to mantle-length....1 :	2.27	2.20	2.26	2.19	2.23	.....	2.21	1.98	2.17	2.06	2.41	1.92	2.36	2.03	2.09	1.84	2.22
Dorsal arms to mantle-length....1 :	.....	4.06	4.26	.....	4.05	.....	.....	3.54	.....	.....	.....	3.29	.....	4.39	.....	.....	.....
Large tentacular suckers to mantle-length....1 :	.....	50.00	53.80	.....	42.39	.....	.....	45.90	.....	.....	.....	38.12	.....	56.87	.....	.....	.....

D.—*Table illustrating variations in the males, &c.*—Continued.

Loligo Pealei (♂).	W.	I.	L.	M.	N.	T.	*a''*.	K.	*f*.	*g*.	*h*.	V.	*b''*.	*c*.	*d*.	*e*.
Tail to end of longest sessile arms	11.70	11.15	11.85	11.20	10.35	10.65	11.30	11.25	11.40	9.90	9.45	9.05	8.65	8.10	7.55	7.00
Tail to mantle-edge, above	8.20	8.20	8.10	7.90	7.80	7.80	7.60	7.50	7.50	6.50	6.20	5.80	5.70	5.30	4.90	4.15
Tail to mantle-edge, below	7.10	7.65	7.60	.....	6.90	7.30	6.80	7.10	6.70	5.90	5.40	5.05	5.30	4.75	4.50	3.80
Tail to insertion of fin	5.00	4.95	4.90	5.00	4.80	4.80	4.60	4.55	4.40	3.75	3.50	3.40	3.20	3.00	2.60	2.20
Tail to center of eye	8.15	8.00	8.40	7.90	7.70	8.00	7.50	7.50	7.60	6.30	6.11	6.40	5.70	5.15	4.90	4.80
Tail to base of dorsal arms	8.70	8.30	7.90	8.40	8.40	8.40	8.90	8.25	8.10	7.00	6.55	6.75	6.40	5.75	5.25	4.95
Eye to end of dorsal arms	3.05	2.80	2.90	2.75	2.30	2.20	3.20	3.50	3.50	2.90	2.60	2.30	2.40	2.45	2.05	1.95
Eye to end of 2d pair of arms	3.40	2.90	3.30	3.00	2.50	2.55	3.50	3.60	3.55	3.10	3.00	2.60	2.70	2.60	2.35	2.10
Eye to end of 3d pair of arms	3.55	3.15	3.45	3.30	2.65	2.65	3.80	3.75	3.80	3.60	3.30	2.65	2.95	2.90	2.65	2.20
Eye to end of ventral arms	3.45	3.20	3.45	3.10	2.55	2.60	3.45	3.75	3.80	3.25	3.20	2.60	2.60	2.90	2.35	2.20
Eye to end of tentacular arms	6.20	6.10	6.30	6.00	3.60	4.20	7.00	5.65	6.30	6.80	5.30	5.10	6.80	5.45	4.60	4.60
Breadth of head across eyes	1.25	1.30	1.00	1.20	1.10	1.15	1.40	1.20	1.20	1.25	1.10	.75	1.10	1.00	1.10	1.10
Breadth of head in front of eyes	1.20	1.10	1.00	.....	.90	1.00	1.35	1.05	1.25	1.10	.90	.75	.95	.95	.95	.95
Breadth of body	1.50	1.35	1.35	.....	1.30	1.20	1.60	1.40	1.60	1.25	1.30	1.00	1.10	1.15	1.10	1.00
Breadth of fins	3.90	3.80	3.65	3.50	3.30	3.25	3.70	3.80	3.70	3.40	3.35	2.85	2.90	2.40	2.50	2.30
Circumference of body	4.60	4.20	3.80	3.15	3.60	3.40	4.65	4.05	4.30	3.80	4.15	3.40	3.45	3.35	3.20	2.90
Length of tentacular club	1.95	1.80	2.00	1.75	1.25	1.50	2.50	2.10	2.40	2.20	1.95	1.50	1.70	1.80	1.50	1.25
Length of dorsal arms	2.18	2.12	.....	.....	.....	.....	.....	.....	.....	.....	2.05	.....	.....	.....	.....	.....
Diameter of largest tentacular suckers	.19	.16	.....	.....	.....	.....	.....	.....	.....	.....	.15	.....	.....	.....	.....	.....
Diameter of largest on 3d pair of arms	.10	.10	.....	.....	.....	.....	.....	.....	.....	.....	.11	.....	.....	.....	.....	.....
PROPORTIONS.																
Length of fin to mantle-length.....1 :	1.64	1.65	1.65	1.58	1.62	1.62	1.65	1.64	1.70	1.75	1.77	1.70	1.78	1.76	1.88	1.90
Breadth of fin to mantle-length.....1 :	2.10	2.16	2.21	2.25	2.36	2.40	2.06	1.97	2.03	1.91	1.85	2.18	1.96	2.20	1.96	1.80
Breadth of fin to its length.....1 :	1.28	1.30	1.34	1.43	1.45	1.47	1.24	1.19	1.19	1.09	1.04	1.28	1.10	1.25	1.04	.96
Circumference of body to mantle-length.....1 :	1.78	1.95	2.13	2.50	2.16	2.29	1.63	1.85	1.74	1.71	1.49	1.70	1.65	1.58	1.53	1.43
Dorsal arms to mantle-length.....1 :	3.76	3.86	.....	.....	.....	.....	.....	.....	.....	.....	3.02	.....	.....	.....	.....	.....
Diameter of tentacular suckers to mantle-length...1 :	43.15	51.25	.....	.....	.....	.....	.....	.....	.....	.....	41.33	.....	.....	.....	.....	.....

Those marked D–W were taken in Vineyard Sound, May and June, 1876, and were preserved in too strong alcohol, some of them (as T–W) being very much contracted; X, Y, Z, were captured June 6, at the same place, and are in fair condition, though too much hardened by the alcohol. Those marked *a–e* were taken October 14, 1875, in the pounds at Wood's Holl, Vineyard Sound, and are well preserved; *h* and *k* are from Savin Rock, near New Haven; *oo* is from Noank, Conn.

E.—*Table illustrating variations of the female. due mostly to age and mode of preservation (measurements in inches).*

Loligo Pealei (♀), typical variety.	13 V.	1 V.	A A.	12 V.	B B.	2 V.	11 V.	D D.	C C.	F F.	♀ U.	E E.	H H.	G G.
Tail to mantle-edge, above	10.00	9.40	9.10	8.62	8.60	8.30	8.25	7.95	7.70	7.65	7.40	7.20	6.10	5.95
Tail to mantle-edge, below	.....	8.50	7.70	.....	7.70	7.60	.....	7.20	7.00	6.80	5.20	6.65	5.50	5.30
Tail to origin of fin	6.35	6.20	5.20	5.50	5.30	5.10	4.75	4.70	4.70	4.20	4.80	4.40	3.65	3.60
Tail to center of eye	.....	9.60	9.75	9.00	8.20	8.70	9.15	8.10	7.80	8.00	3.00	7.60	6.05	6.00
Tail to base of dorsal arms	11.40	10.50	10.10	9.75	9.40	9.50	9.75	9.05	8.20	8.30	5.20	8.80	6.50	6.70
Length of dorsal arms	3.60	.....	.....	2.82	.....	.....	3.15	2.10	.....	2.35	5.70	.....	1.76	1.53
Eye to tip of dorsal arms	.....	4.00	3.05	.....	3.60	4.15	.....	2.95	2.60	2.80	1.90	3.10	2.20	2.20
Eye to tip of 2d pair of arms	.....	4.15	3.40	.....	4.10	4.40	.....	3.10	2.80	3.00	1.90	3.50	2.50	2.25
Eye to tip of 3d pair of arms	.....	4.90	3.55	.....	4.15	5.20	4.85	3.40	3.20	3.20	2.20	3.60	2.80	2.40
Eye to tip of 4th pair of arms	.....	4.50	3.55	.....	3.60	4.50	.....	2.85	3.10	3.20	2.20	3.45	2.40	2.20
Eye to tip of tentacular arms	.....	10.00	5.30	8.25	5.70	9.00	9.50	4.45	4.40	5.10	3.05	5.30	5.20	3.70
Length of club	.....	2.15	2.00	2.30	2.35	2.10	2.55	1.60	1.65	1.90	1.00	1.75	1.55	1.30
Breadth of head at eyes	1.60	1.50	1.30	1.58	1.40	1.40	1.55	1.40	1.30	1.25	.90	1.30	1.05	1.10
Breadth of head in front of eyes	.....	1.25	1.25	.....	1.30	1.20	.....	1.20	1.20	1.10	1.00	1.10	.90	.95
Circumference of head in front of eyes	4.25	.....	.....	3.80	.....	.....	3.55	3.55	.....	3.50	2.55	.....	3.00	2.90
Breadth of body	1.90	1.85	1.70	1.70	1.60	2.00	1.75	1.40	1.40	1.45	3.05	1.60	1.40	1.10
Breadth of caudal fins	4.75	4.60	5.15	4.50	4.70	4.80	4.60	4.10	4.10	3.60	.95	4.00	3.20	3.10
Breadth between insertions of fins	1.50	.....	.....	1.37	.....	.....	1.30	.....	.....	.....	.....	.....	.....	.....
Circumference of body	5.75	5.50	5.30	5.40	4.90	5.50	5.15	4.40	4.30	4.30	.....	4.80	3.90	3.45
Diameter of largest tentacular suckers	.23	.20	.19	.19	.26	.21	.19	.....	.15	.18	.....	.18	.15	.11
Diameter of largest on 3d pair of arms	.15	.13	.12	.13	.14	.16	.12	.....	.10	.12	.....	.10	.10	.08
PROPORTIONS.														
Fin-length to mantle-length 1:	1.57	1.51	1.75	1.56	1.62	1.62	1.73	1.69	1.63	1.82	1.73	1.63	1.67	1.65
Fin-breadth to mantle-length 1:	2.10	2.04	1.82	1.91	1.82	1.72	1.79	1.95	1.87	2.12	2.03	1.80	1.90	1.90
Breadth to length of fin 1:	1.34	1.34	1.00	1.22	1.12	1.06	1.03	1.14	1.14	1.16	1.17	1.10	1.14	1.16
Circumference of body to mantle-length 1:	1.74	1.70	1.71	1.59	1.75	1.50	1.60	1.80	1.79	1.77	.....	1.50	1.56	1.72
Length of dorsal arms to mantle-length 1:	2.78	.....	.....	3.05	.....	.....	2.62	3.78	.....	3.25	.....	.....	3.46	3.23
Tentacular suckers to mantle-length 1:	43.50	47.00	49.47	45.36	33.07	39.50	43.42	.....	51.33	42.50	.....	40.00	40.66	54.09

A A to H H were taken in the fish-pounds at Wood's Holl, Vineyard Sound, in June, 1876, and have been preserved in somewhat too strong alcohol. 1 V to 13 V were taken at the same place, May 28, 1880, and have been carefully preserved in alcohol of about 80 per cent.

F.—*Table illustrating variations of males of var. pallida, due to growth, to the states of contraction when preserved, and to individual peculiarities (measurements in inches).*

Loligo Pealei var. pallida (♂).	B.	I.	b.	Z.	A.	c.	G.	E.	i.	d.	h.	e.	k.
Tail to edge of mantle, above	9.30	9.15	9.00	8.70	8.50	8.20	8.00	8.00	7.95	7.65	7.90	7.70	7.55
Tail to edge of mantle, beneath	8.65	8.50	8.25	8.10	7.70	7.60	7.30	7.20	7.35	7.60	7.20	7.00	6.80
Tail to origin of fin	5.80	5.80	5.40	5.25	5.20	5.00	5.05	4.90	5.00	4.75	4.70	4.65	4.50
Tail to center of eye	9.60	9.85	9.30	9.20	8.80	8.70	8.70	8.40	8.30	8.00	8.05	7.80	7.80
Tail to base of dorsal arms	10.60	10.70	10.25	9.75	9.50	9.60	9.50	9.10	9.35	8.65	8.80	8.70	8.70
Eye to end of dorsal arms	4.45	4.15	4.10	3.80	4.20	4.10	4.00	3.80	4.05	3.55	3.50	4.00	3.40
Eye to end of 2d pair of arms	5.20	4.70	4.40	4.30	4.40	4.45	4.20	4.00	4.35	4.00	3.90	4.10	3.75
Eye to end of 3d pair of arms	5.20	5.20	4.70	4.55	4.80	5.20	4.50	4.30	4.80	4.30	4.45	4.55	4.15
Eye to end of 4th pair of arms	4.70	5.00	4.45	4.05	4.50	4.80	4.35	4.10	4.45	4.00	4.05	4.30	3.80
Eye to end of tentacular arms	10.30	10.80	9.30	9.90	10.15	9.10	9.50	8.90	9.90	9.00	8.75	9.30	6.70
Length of club of tentacular arms	2.90	2.80	2.60	2.50	2.80	2.75	2.60	2.15	2.50	2.65	2.60	2.70	2.60
Breadth of head across eyes	1.60	1.50	.....	1.35	1.60	1.45	1.38	1.30	1.20	.....	1.45	1.40	1.20
Breadth of head in front of eyes	1.40	1.20	1.20	1.15	1.40	1.30	1.20	1.00	1.15	.....	1.25	1.15	1.05
Breadth of body	2.00	1.80	.....	1.70	1.60	.....	2.10	1.60	.....	.....	1.65	.....	.....
Breadth of caudal fins	5.15	5.00	4.50	4.60	5.00	4.60	4.50	4.50	4.50	3.90	4.40	4.10	3.75
Circumference of body	5.75	5.50	5.00	4.90	5.15	5.25	5.25	4.70	5.10	5.00	5.20	5.05	4.60
Diameter of largest suckers of club	.24	.22	.....	.20	.21	.....	.23	.18	.....	.....	.21	.....	.....
Diameter of largest suckers on 3d pair of arms	.13	.14	.....	.11	.13	.....	.12	.12	.....	.....	.13	.....	.....
PROPORTIONS.													
Length of fin to length of mantle 1:	1.60	1.57	1.66	1.65	1.66	1.64	1.58	1.63	1.59	1.61	1.68	1.65	1.67
Breadth of fin to length of mantle 1:	1.80	1.83	2.00	1.88	1.70	1.78	1.77	1.77	1.76	1.96	1.79	1.87	2.01
Breadth of fin to its length 1:	1.12	1.16	1.20	1.14	1.00	1.08	1.12	1.08	1.11	1.21	1.06	1.13	1.20
Large tentacular suckers to mantle-length....1:	38.75	41.59	.....	43.50	40.47	.....	34.78	44.44	.....	.....	37.62	.....	.....
Circumference of body to mantle-length 1:	1.61	1.66	1.80	1.77	1.65	1.56	1.52	1.70	1.55	1.53	1.51	1.52	1.64

All the specimens included in this table were taken nearly at the same time, in November and December of 1871, at Astoria, Long Island. The measurements are all from the specimens after they had been preserved in alcohol (of about 80 per cent.) for several years. They are only moderately contracted by the alcohol. They were sent to New Haven, in ice, before preservation, so that they were in a relaxed condition when put into alcohol.

F.—*Table illustrating variations of males of var. pallida, &c.*—Continued.

Loligo Pealei var. pallida (♂).	J.	f.	W.	l.	V.	a.	K.	L.	M.	Q.	S.	P.
Tail to edge of mantle, above	7.30	7.10	7.00	7.10	6.60	4.30	4.00	4.00	3.80	3.70	3.70	3.65
Tail to edge of mantle, beneath	6.70	6.50	6.20	6.30	6.10	3.80	3.40	3.40	3.20	3.20	3.30	3.20
Tail to origin of fin	4.40	4.00	4.20	4.30	3.90	2.30	2.10	2.00	2.00	2.00	1.80	2.00
Tail to center of eye	7.70	7.55	7.40	7.50	7.00	4.75	4.50	4.20	4.05	4.20	3.90	3.90
Tail to base of dorsal arms	9.15	8.30	8.15	1.80	7.30	5.20	5.00	4.70	4.50	4.60	4.30	4.40
Eye to end of dorsal arms	3.70	3.70	3.50	3.70	3.10	2.30	2.00	2.15	2.00	2.10	1.80	1.80
Eye to end of 2d pair of arms	4.00	3.80	3.60	4.15	3.70	2.50	2.30	2.50	2.20	2.40	1.90	2.10
Eye to end of 3d pair of arms	4.45	4.10	4.20	4.55	4.10	3.00	2.55	2.70	2.50	2.70	2.30	2.60
Eye to end of 4th pair of arms	4.30	3.80	4.00	4.00	3.60	2.70	2.20	2.65	2.45	2.40	2.30	2.20
Eye to end of tentacular arms	------	9.30	8.60	9.25	7.70	6.45	4.80	5.90	5.90	6.10	5.50	5.25
Length of club of tentacular arms	------	2.30	2.40	2.60	2.00	1.50	1.30	1.45	1.30	1.20	1.20	1.00
Breadth of head across eyes	1.20	1.25	1.20	1.20	1.20	.90	.90	.90	.80	.80	.80	.80
Breadth of head in front of eyes	1.10	1.10	1.00	.95	1.10	.75	.80	.75	.70	.70	.65	.70
Breadth of body	------	------	------	1.65	------	------	------	------	------	------	------	------
Breadth of caudal fins	4.10	3.95	4.00	3.90	3.30	2.40	2.10	2.50	2.00	2.00	2.10	1.90
Circumference of body	4.70	4.45	4.75	4.80	4.60	3.60	3.30	3.60	3.10	3.25	3.35	3.25
Diameter of largest suckers of club	------	------	------	.21	------	------	------	------	------	------	------	------
Diameter of largest suckers on 3d pair of arms	------	------	------	.13	------	------	------	------	------	------	------	------
PROPORTIONS.												
Length of fin to length of mantle....1:	1.65	1.77	1.66	1.69	1.69	1.86	1.90	2.00	1.90	1.85	2.05	1.85
Breadth of fin to length of mantle....1:	1.77	1.79	1.75	1.89	2.00	1.79	1.90	1.60	1.90	1.85	1.76	1.92
Breadth of fin to its length....1:	1.07	1.01	1.05	1.12	1.18	.95	1.00	.80	1.00	1.10	.85	1.05
Largest tentacular suckers to mantle-length....1:	------	------	------	33.80	------	------	------	------	------	------	------	------
Circumference of body to mantle-length....1:	1.55	1.59	1.47	1.47	1.43	1.19	1.21	1.11	1.22	1.13	1.10	1.12

G.—*Table illustrating variations of females of var. pallida, due to growth, &c. (measurements in inches).*

Loligo Pealei var. pallida ♀).	j.	Y.	l.	X.	D.	g.	m.	C.	T.	U.	H.	n.	F.	♀ sex O.	R.	N.
Tail to edge of mantle, above	8.40	8.15	7.00	6.70	6.35	6.25	6.20	5.10	4.65	4.60	4.25	3.90	3.85	3.60	3.60	3.62
Tail to edge of mantle, beneath	7.65	7.35	6.30	6.00	5.80	5.75	5.70	4.35	3.90	4.00	3.70	3.40	3.35	3.20	3.20	3.10
Tail to origin of fin	5.15	4.80	4.30	4.20	3.90	3.70	3.60	2.80	2.55	2.50	2.30	2.00	2.00	2.00	2.00	1.95
Tail to center of eye	8.80	8.50	7.35	7.10	6.50	6.70	6.50	5.25	4.80	4.70	4.30	4.20	4.15	4.00	4.00	4.00
Tail to base of dorsal arms	9.50	9.15	8.20	8.00	7.30	7.40	7.15	6.00	5.20	5.25	5.00	4.45	4.60	4.50	4.30	4.30
Eye to end of dorsal arms	4.15	3.80	3.60	3.30	3.30	3.00	3.00	2.10	2.05	2.40	2.00	1.30	1.90	1.60	1.80	1.80
Eye to end of 2d pair of arms	4.50	4.40	4.00	3.95	3.80	3.30	3.20	2.50	2.40	2.70	2.20	2.00	2.20	2.20	1.90	1.90
Eye to end of 3d pair of arms	5.00	4.60	4.60	4.30	3.95	3.70	3.70	3.05	2.55	3.15	2.55	2.55	2.65	2.45	2.40	2.25
Eye to end of 4th pair of arms	4.50	4.35	4.35	4.25	3.80	3.60	3.70	3.05	2.55	3.15	2.70	2.25	2.55	2.20	2.40	2.25
Eye to end of tentacular arms	10.10	9.30	9.80	9.10	8.90	7.80	8.30	7.10	5.50	6.50	5.45	5.15	5.90	5.20	5.30	5.10
Length of club of tentacular arms	2.90	2.45	2.70	2.60	2.20	2.00	2.10	1.60	1.10	1.40	1.20	1.30	1.35	1.10	1.80	1.15
Total length, tail to end of tentacles	19.00	17.80	17.10	16.20	.....	14.45	15.00	12.00	.90	11.20	.....	9.20	.....	9.25	9.25	9.15
Breadth of head across eyes	1.45	1.40	1.30	1.30	1.40	1.10	1.15	1.00	.80	1.00	.90	.95	.90	.80	.90	.85
Breadth in front of eyes	1.30	1.30	1.20	1.20	1.10	.90	1.00	.85	.....	.85	.75	.80	.60	.70	.75	.70
Breadth of body	1.90	1.85	.....	.....	1.55	.....	.....	1.40	2.70	.....	1.35	.....	1.20	.....	.....	.....
Breadth of caudal fins	4.80	4.40	4.10	4.60	4.10	3.50	3.60	3.10	3.75	2.80	2.65	2.45	2.25	2.10	2.25	2.05
Circumference of body	5.50	5.50	4.80	4.90	4.60	4.40	4.40	4.20	.....	4.00	.....	3.50	3.50	3.20	3.25	3.05
Diameter of largest suckers on club	.25	.20	.....	.22	.17	.18	.16	.15	.....	.12	.....	.....	.08	.....	.....	.....
Diameter of largest suckers on 3d pair of arms	.12	.13	.....	.12	.10	.11	.11	.80	.....	.08	.....	.....	.05	.....	.....	.....
PROPORTIONS.																
Length of fin to length of mantle.....1 :	1.63	1.69	1.62	1.59	1.62	1.68	1.72	1.82	1.82	1.84	1.84	1.95	1.92	1.80	1.80	1.85
Breadth of fin to length of mantle .....1 :	1.75	1.85	1.70	1.45	1.54	1.78	1.72	1.65	1.72	1.64	1.60	1.59	1.71	1.71	1.60	1.76
Breadth of fin to its length.....1 :	1.07	1.09	1.04	.91	.95	1.05	1.00	.90	.94	.89	.86	.81	.88	.95	.88	.95
Largest tentacular suckers to mantle-length.....1 :	33.60	40.75	.....	30.45	37.35	34.72	38.75	34.00	.....	38.33	.....	.....	48.12	.....	.....	.....
Circumference of body to mantle-length .....1 :	1.52	1.48	1.45	1.36	1.38	1.42	1.40	1.21	1.24	1.15	.....	1.11	1.10	1.12	1.10	1.18

The specimens included in this table were all taken at Astoria, Long Island. The measurements are all from alcoholic specimens, as in Table F.

I.—*Table to illustrate the rate of growth of Loligo Pealei, young.*

Locality.	Depth.	Date.	Length of mantle, in millimeters.	
			Young of the year.	Young of previous year.
		1875–'76.		
Vineyard Sound	Surface	July 7	36=25–35mm: 3=45–48mm	10=75–100mm.
Do	do	July 12	100+=10–20	
Do	do	July 15	4=50–68	9=70–100.
Do	do	July 16	500+=10–25	
Do	do	July 28	500+=10–30	
Do	do	Aug. 2	200+=15–35	
Do		Aug. 21	26=27–52	
Do		Aug. 27	18=23–50	
Do		Aug. 28	38=25–50: 2=55–63	
Do		Aug. —	30=25–45: 10=47–72	2 ♀=125–150: 1 ♂=175.
Do	6–20	Sept. 15	3=45–50	2=125–138.
Do		Oct. 13		1=188.
Do		Oct. 20	4=88–100	4=112–125.
Do	Surface	Nov. 1	1000=8–20: 3=75–82	1=152.
Do	do	May 15		3=152–188.
Do	do	June 3		80=62–100: 10=100–152.
		1880.		
Newport, R. I	Shore	July 27	4=28: 5=32–44	5=67–80: 1=95.
Narragansett Bay	8	Aug. 6	5=45–50	3=84–100.
Off Newport, R. I	16–26	Aug. 7	54=15–33: 49=32–44: 5=50–62	3=89–108: 2=120–165.
Do	16–19	Aug. 12	90=15–25: 15=30–40	
Off Point Judith, R. I	16	Aug. 13	60=17–38: 20=38–55	1=115: 1=102.
Do	19	Aug. 14	133=16–33: 8=38–44	2=86–87: 2 ♀=105–112.
Narragansett Bay	4–12	Aug. 16	33=23–55: 14=50–70: 3=75–82	3=83–95.
Off Buzzard's Bay	21	Aug. 17	72=12–28: 5=30–42	
Narragansett Bay	6	Aug. 23	2=48–53: 3=70–80	
Off Block Island	13	Aug. 24	9=24–36: 8=40–55	
Do	5	Aug. 27	1 ♂=84	1 ♀=110.
Narragansett Bay	14	Aug. 31	7=38–46: 2=60–62	
Do	3–6	Sept. 1	2=32–46: 11=50–52	
Off Cuttyhunk Island	17	Sept. 3	23=32–50: 4=56–58: 1=82	2=130–140
North latitude 39° 48′ 30″, west longitude 70° 54′	252	Sept. 13	14=16–30	
Off Block Island		Sept. —	20=42–55: 10=55–72: 1=110	
Off Chesapeake Bay	18	Nov. 16	32	
VARIETY BOREALIS.				
		1878.		
Massachusetts Bay	10	Aug. 29	1=31	
Do	42	Sept. 16	1=38	
Do	47	Sept. 21	6=28–38: 1=50: 5=62	
Do	43	Sept. 26	2=31–38	
		1879.		
Off Cape Cod	15½	Sept. 9	2=38	
Do	42	Sept. 26	1=75	
Cape Ann	Shore	Oct., '80	5 ♂ 3 ♀=110–156	

J.—*Loligo Pealei. Specimens examined, mostly adult. To illustrate distribution, &c.*

[In last column *ad.*=adult; *br.*=breeding; *in.*=length of mantle in inches; *j.* or *juv.*=young *lg.*=large.]

No.	Locality.	Fath.	When collected.	Received from—	Specimens, sex and number.
	TYPICAL VARIETY.				
	New Haven, Conn		1867	Mr. Hooes	1 ♂.
	do			G. H. Perkins	1 ♂.
	Near New Haven	Shore	1870	A. E. Verrill	4 ad.
h. k	do	do	1874	do	♂ 4 ad.
c′	do	do	1876	do	6 ad.
1G	New Haven Harbor	do	May 18, 1880	do	♂ 1 lg. br.
	Long Island	do		C. C. Byrne	1 juv.
a′, b′, oo	Noank, Conn	do	1874	U. S. Fish Com.	♂ 3 large.
	do	3–4	August 5, 1874	do	4 juv.
	do	6–8	August 24, 1874	do	8 juv.

J.—*Loligo Pealei*—Continued.

No.	Locality.	Fath.	When collected.	Received from—	Specimens, sex and number.
	TYPICAL VARIETY—Continued.				
	Vineyard Sound, Mass.	Shore	July and Aug., 1871	U. S. Fish Com.	72 ad.
	do	5–8	do	do	30 ad.
	Menemsha	Shore	August, 1874	V. N. Edwards	♂ 1: ♀ 2.
	Vineyard Sound	do	July and Aug., 1875	U. S. Fish Com.	7 ad.
	do	5–12	July 12–26, 1875	do	Eggs and juv.
	do	5–16	August 4, 5, 1875	do	juv.
	do	6–20	September 15, 1875	do	5 juv.
	do	Shore	October 13, 1875	V. N. Edwards	3=5–7.5 in.
f, g	do	do	October 14, 1875	do	3=5–7 in.
a–e	do	do	do	do	♂ 5 large.
	do	do	October 20, 1875	do	5=4–5 in.
	do	do	November 1, 1875	do	1=6 in.
	do	do	April 30, 1876	do	♂ 10: ♀ 3.
	do	do	May 15, 1876	do	3=6–7 in.
D–W	do	do	May and June, 1876	do	♂ 15: ♀ 4 ad.
	do	do	June 3, 1876	do	♂ 3=5–6 in.
X. Y. Z	do	do	June 6, 1876	do	♂ 3 large.
AA–HH	do	do	June, 1876	do	39 ad.: ♀ 12.
1V–60 V	do	do	May 28, 1880	do	♂ 48: ♀ 12 br.
	Narragansett Bay	do	1880	Samuel Powell	10 ad.
A 1	Hyannis, Mass	do	August, 1880		♂ 1 very lg.
	Narragansett Bay	do	July 27, 1880	U. S. Fish Com.	6 j.=3–3.7 in.
	Off Newport, R. I	16–26	August 7, 1880	do	5 j.=3.5–6.5 in.
	Off Point Judith, R. I.	19	August 14, 1880	do	2 j.=1.1–1.4 in.
	Off Cuttyhunk Island	17	September 3, 1880	do	2=5.1–5.5 in.
	South of Block Island	252	September 13, 1880	do	14 juv.
	Off Chesapeake Bay	18	November 16, 1880	Z. L. Tanner	32 juv.
	VARIETY BOREALIS.				
An. 1–3 *g*	Annisquam, Mass	Shore	July, 1878	A. Hyatt	♀ 3 ad. br.
	Gloucester, Mass	do	do	A. E. Verrill	2 juv.
	Massachusetts Bay	47	September 21, 1878	U. S. Fish Com.	11 juv.
	Off Cape Cod	42	September 26, 1879	do	1 juv.
	Provincetown, Mass	Shore	July, 1879	J. H. Blake	3 large.
2G–15G	Cape Ann, Mass	do	May 18, 1880	A. H. Clarke	15 ad. br.
	do	do	October, 1880	do	♂ 5: ♀ 3 juv.
	Salem, Mass	do		J. H. Emerton	♂ 1: ♀ 2 ad.
	VARIETY PALLIDA.				
A–Z	Astoria, N. Y	Shore	Nov. and Dec., 1870	Robert Benner	♂ 17: ♀ 9.
a–t	do	do	do	do	♂ ♀ 20 ad.
1–10	do	do	do	do	♂ ♀ ad.
	Great Egg Harbor, N. J.	do	1872	A. E. Verrill	1, bass stom.

K.—*Specimens examined. Eggs and recently-hatched young of Loligo Pealei.*

Locality.	Fath.	When collected.	Received from—	Eggs or embryos.
Near New Haven	Shore	June 19, 1871	J. E. Todd	Well developed.
Vineyard Sound	5–10	July, Aug., 1871	United States Fish Com.	All stages.
Long Island Sound	4–8	August, 1874	do	Well developed.
Fisher's Sound	Surface	July 28, 1874	do	Just hatched.
Nantucket Sound	8–12	July 26, 1874	do	Partly developed.
Vineyard Sound	8–16	August 5, 1875	do	Do.
Do	5–10	July, Aug., 1875	do	All stages.
Do		Sept. 6, 1875	do	New laid.
Near New Haven	Shore	June 11, 1880	S. I. Smith	Near hatching.
Off New Haven		August 3, 1880	J. F. Fowle	Half developed.
Gardiner's Bay		June 28, 1880	Schooner G. H. Bradley	New laid.
Off Newport, R. I	8	August 6, 1880	United States Fish Com.	Fresh and well developed.
Do	22–26	August 7, 1880	do	New laid and hatching.
Do	4½	August 16, 1880	do	New laid and partly developed.
Narragansett Bay	6	August 23, 1880	do	Fresh laid.
Do	12½	August 31, 1880	do	Partly developed.
Buzzard's Bay	4–6	August 26, 1881	do	Just hatching.

Notes on the visceral anatomy of Loligo Pealei.

(*See Plate XX, fig.* 2; *Plate XXIX, figs.* 1–3*a*; *Plate XXXII, figs.* 2, 3.)

The gills (*g*) are large and highly organized in this species, although considerably smaller than in *Ommastrephes*. The bases of the gills (*g*) are situated somewhat in advance of the middle of the mantle-cavity, or branchial chamber, and their tips, in fresh specimens, extend forward nearly to the base of the siphon (*f*). The branchial chamber is separated from the visceral cavity by a thin translucent membrane (the so-called peritoneal membrane), through which there are two circular openings (*iu*), one a short distance in advance of the base of each gill; through these the secretion of the urinary organs (*r*, *r'*) is doubtless discharged. Internally the visceral cavity is divided into several compartments by folds of thin membrane. The largest of these chambers contains the stomach and its cœcal lobe (S, S'). When the branchial cavity is opened on the ventral side, as in Pl. XXIX, fig. 1, and the thin membranes covering the viscera are removed, the renal organs (*r*, *r'*) are seen as large and conspicuous organs, especially if the venous system has been injected with a colored fluid. These organs are mostly situated close around the heart, above, below, and in front of it, but two of them, in the form of pyriform glands (*r'*, *r'*), which are firmer and have a more compact structure than the rest, extend along the posterior venæ-cavæ. These extend forward and unite with the two elongated, saccular organs (*r*, *r*), which extend across the ventral side of the heart and the bases of the gills, and passing farther forward, unite on the dorsal side of the intestine to form the anterior vena-cava; before they thus unite each one receives a vein from the intestine (*r''*) and gives off a large sacculated vessel, or branch, which, passing upward along the sides of the proximal part of the intestine, unite with two large lobulated renal sacs, which lie above and in front of the heart and surround the commencement of the intestine; these send tapering lobes backward, which receive the blood from the gastric veins; anteriorly they receive the hepatic veins; laterally they receive the large vessels or pallial veins from the sides of the mantle, and also communicate with the branchial auricles.

The heart (H) is a large, muscular, and somewhat unsymmetrical organ, varying in shape according to the state of contraction. Usually it is more or less obliquely four-cornered, with the right side largest and the posterior end more or less conical. From the posterior end arises a large artery, the posterior aorta, which gives off, close to its origin, two small arteries; one of these is median and goes forward to the ink-sac and intestine, passing below and across the heart; the other, arising laterally, in the male goes to the prostate gland and other organs connected with it (Pl. XXIX, fig. 2, *po*). A little farther back the posterior aorta divides into three large arteries; one of these (*o*) is situated in the median plane, and, crossing the branchial cavity along the curved

anterior end of a thin, median, membranous partition, supplies the ventral and lateral portions of the mantle, sending branches both backward and forward; the other two main divisions (*o'*, *o''*) diverge as they go backward, and supply the caudal fins and adjacent parts of the mantle. The anterior aorta (*ao*) arises from the right anterior corner of the heart, and goes forward to the head, on the right side of the median line, by the side of the œsophagus. Just beyond the constriction, at its origin, it is somewhat bulbous. A short distance from its origin it gives off a large branch, the gastric artery (*so*), which sends a branch to the renal organs, and passes backward over the dorsal side of the heart to the anterior parts of the stomach, where it ramifies extensively.

The portion of the aorta which passes along and through the liver gives off several hepatic arteries that supply blood to the liver, and one branch emerges from the liver, on the dorsal side, and supplies the muscles of the neck-region. The ultimate divisions of the aorta supply the various organs of the head, and a large branch goes out to the tip of each arm, nearly in the center, sending branches to the suckers. A small vessel, the spermatic artery (fig. 2, *go*), arises from the anterior side of the heart, and, passing backward over the heart, supplies the spermary (*t*).

The large efferent or branchio-cardiac vessels from the gills (*bo*) enter the anterior lateral corners of the heart, their dilated basal portion serving, apparently, as auricles. The branchial auricles (*au*), situated just behind the bases of the gills, are nearly globular, with a small, rounded, whitish elevation on the free posterior end; anteriorly they receive the blood from the sacculated divisions of the anterior and posterior venæ-cavæ, above the heart, and from the veins (*v*, *vc'*) coming from the lateral portions of the mantle, behind the gills, and they give off the large afferent vessels (*bv*), which go to and run along the dorsal side of the gills. The anterior vena-cava (*vc*) receives the venous blood from a large cephalic venous sinus * which surrounds the pharynx, at the bases of the arms, and is also directly connected with another large sinus at the back of each eye-orbit. This cephalic sinus receives the blood from a large vein in the median line and near the inner face of each arm. The ophthalmic sinuses receive veins from the eye itself. Numerous small veins enter the anterior *vena-cava*, from each side, along its course, coming from the muscles of the head, neck, and siphon, and from the ink-sac, liver, &c. Two veins, sacculated posteriorly, go from the ink-sac and intestine back to the renal organs. A small but very distinct vein extends along the dorsal side of the efferent sperm-duct (*p*). Two large pallial veins, on each side, come

* The greater part of the venous system can be easily injected by inserting the canula into this sinus, through the folds of the buccal membranes, just between the bases of the arms and the jaws, or between the outer and inner buccal membranes. It can also be easily injected through the vena-cava in the lower side of the head.

from the sides of the mantle (*v*, *vc'*): one of them (*vc'*), receiving a branch from the gill, runs from the anterior part backward; the other (*v'*), from the middle part forward; these unite into one trunk before reaching the *venæ cavæ*. The posterior *venæ-cavæ* (*vc''*) arise mostly from the caudal fins, but receive branches from the postero-lateral portions of the mantle; each one receives two large branches, one anterior and the other posterior, just at the point where it leaves the inner surface of the mantle. From this point they run forward, parallel with the two posterior arteries, and converge to the region of the heart, where they join the great sacculated venous vessels; along a considerable portion of their course they expand and become large, elongated, fusiform organs (*r''*), probably renal in function, but much firmer, more definite in form, and finer in structure than the more anterior renal organs.

The gills (*g*) are long, triquetral, acute; in section they are nearly triangular (Pl. XXXII, fig. 3), with the free ventral sides convex, and the dorsal side flat or concave, except along the middle, where a thin median membrane (*d*) arises from a central ridge and unites the gill to the inner surface of the mantle. The gills are composed of large numbers of thin, transverse branchial laminæ (Fig. 3, *a*), which extend outward symmetrically, on each side, from the large median blood-vessels (*bo*, *bv*), each half of a lamina having a long ovate or elliptical outline. A somewhat firm central axis or column (*c*) gives support to the laminæ and the large blood-vessels. The great afferent vessel (*bv*) starts from the branchial auricle and runs along the median dorsal side of the gill, on the inner edge of the axial column (*c*); another parallel venous trunk or sinus (*v*) is seen near the dorsal edge of the column. Each branchial leaf receives from the afferent vessel (*bv*) a branch (*b*) which runs along the dorsal edge, giving off at regular intervals small transverse parallel branchlets, which in turn give off minute capillary vessels along their sides and fade out near the ventral border of the lamellæ. Parallel with these arise small capillary efferent vessels, which join larger transverse vessels between and parallel with the afferent ones; these in turn join the larger efferent vessel that runs along the ventral edge of the lamina, and these marginal vessels pour their contents into the large vessel (*bo*) which runs along the middle of the gill on the ventral side and carries the purified blood to the heart.

The alimentary tract is represented in a nearly dorsal view in Plate XX, fig. 2. In this figure the pharynx is shown in longitudinal section in a side view. The buccal membrane (*bm*); the pharynx with its horny jaws (*sm* the superior, and *im* the inferior mandibles); the odontophore, (*od*) armed with seven rows of recurved teeth on the radula; and the thin chitinous lining membrane, which bears numerous sharp, scattered, recurved teeth, both on the palate and in the throat, have already been described (pp. 134, 135). The œsophagus (*oe*) is a long, narrow, but dilatable tube, having two oblong salivary glands (*sg*) attached to it just at the

bilobed anterior end of the liver (*l*); it then runs backward in a groove along the dorsal side of the liver to a point beyond its middle, where it passes obliquely through the liver, accompanied by the aorta (*ao*), and enters the stomach at *oe'*. The stomach consists of three parts, which are often sufficiently distinct externally when the stomach is empty, or nearly so, but when it is greatly distended with food (as often happens) the divisions almost disappear externally, and the whole becomes one great, long-pyriform sac. The first division (S), or "true stomach," is plicated internally and has thickened glandular walls. It is supplied with blood by a ramified vessel, the gastric artery (*so*), conspicuous on its dorsal surface. This lobe of the stomach is sometimes contracted into a firm glandular mass, strongly constricted where it joins the more saccular second stomach; but I have seen specimens, greatly distended with food, in which it was scarcely or not at all distinguishable as a lobe, and seemed nearly as thin and saccular as the other parts. The remainder of the stomach (S', S'') usually has the form of a long, rounded, more or less swollen, fusiform sac, tapering backward to a more or less acute posterior end, which reaches back nearly to the end of the body; anteriorly its most swollen portion is about opposite the junction with the first stomach and just behind the heart; from this swollen portion it narrows rapidly, but extends forward to the posterior part of the liver, above and in advance of the heart, where it gives off the intestine (*h*). The more swollen and anterior portion of this sac or second stomach (S'') has a glandular lining, which, in part (S''), is distinctly radially plicated; and it is therefore clearly anatomically distinguishable from the thin and non-plicated posterior portion (S') or cœcal lobe, which seems to serve mainly for the temporary storage of large quantities of food. The intestine (*h*, *h'*) is a rather wide, thin tube, of moderate length, it arises from the anterior end of (S''), close to the dorsal side of the heart; the anal orifice (*h'*) is provided with two slender clavate papillæ. The liver (*l*) is a long, rather narrow, somewhat fusiform organ, slightly bilobed anteriorly and pointed posteriorly; along about two-thirds of its length, from the anterior end, there is a deep dorsal groove in which the œsophagus and aorta are situated before they pass through its substance; the posterior end is undivided and pointed.

The ink-sac (*i*) is a large flask-shaped, or long-pyriform, blackish sac, with a long tapering duct (*i'*) terminating just within the anal orifice.

In the appearance and structure of the internal reproductive organs the sexes differ greatly. In the female (Pl. XXIX, figs. 3, 3a; Pl. XXXIII, fig. 2) the single large oviduct (*od*), situated on the left side, passes over the dorsal side of the base of the gill and terminates in a large ear-shaped external orifice (*op*) nearly surrounded by a broad membranous flap. The portion of the oviduct behind the base of the gill is enveloped by a large, swollen, bilobed nidamental gland (Pl. XXIX, figs. 3, 3a, *x'*; Pl. XXXIII, fig. 2, *x'*), which is abundantly supplied with blood-vessels, and internally is comprsed of a large number of thin, close, parallel

lamellæ. Two very large, oblong, accessory nidamental glands (*xx*) lie side by side, loosely attached, nearly in the middle of the ventral side, covering and concealing the heart and most of the renal organs; each of these has a groove along the ventral side and a slit in the anterior end; internally they are composed of great numbers of thin lamellæ.

In front of and partially above the anterior ends of these, and attached to the intestine and ink-sac, there is another pair of accessory glands (*x*), roundish in form, with a large ventral opening, and having, in fresh specimens, a curiously mottled color, consisting of irregular red and dark brown blotches on a pale ground. Their internal structure is finely follicular. The ovary (*ov*) is large and occupies a large portion of the cavity of the body, posteriorly, running back into the posterior cavity of the pen, and in the breeding season extending forward nearly to the heart. In the breeding season the thin convoluted portion of the oviduct (*ov'*) is found distended with great numbers of eggs. At the same time the large glands (*x'*), around the oviduct, and the accessory nidamental glands (*x*, *xx*), destined to furnish the materials for the formation of the egg-capsules, and for their attachment, are very turgid and much larger than at other times.

The male (Pl. XL, figs. 1, 2) has no organs corresponding in position to the two pairs of accessory nidamental glands of the female, but the single efferent spermatic duct (*p*) occupies the same position on the left side as the terminal part of the oviduct of the female. It is, however, a much more slender tube, extending farther forward beyond the base of the gill, and its orifice is small and simply bilabiate. It extends backward over the dorsal side of the base of the gill to a bilobed, long-pyriform organ, consisting of a spermatophore-sac (*ss*) and a complicated system of glands and tubes (*pr*, *vd*) united closely together and inclosed in a special sheath. This organ consists of the following parts:

1. The vas-deferens (*vd*), which starts posteriorly from a small orifice (not figured) in the thin sheath of peritoneal membrane (*pr*) investing the testicle (*t*); it passes forward along the side of the spermatophore-sac, to which it is closely adherent, and throughout its length it is thrown into numerous close, short, transverse, flattened folds; anteriorly it joins the vesiculæ-seminales.

2. The vesiculæ-seminales (fig. 2, *pr*, in part) consist of three large, curved vesicles, closely coiled together, the third one having thickened, glandular walls; from the latter goes a duct which unites with the duct from the prostate gland to form the spermatic duct.

3. The prostate gland (*pr*, in part) consists of two curved lobes, which are closely coiled between and united to the vesiculæ-seminales.

4. The spermatic duct, formed by the union of the ducts from the vesiculæ seminales and prostate glands, is a nearly straight tube; it passes backward between the prostate glands and spermatophore-sac, close alongside of the vas-deferens (*vd*), to which it is closely bound down; it enters the spermatophore-sac (*ss*) near its posterior end, at an acute angle.

5. The spermatophore sac (*ss*) is a long, capacious, pyriform, or somewhat fusiform, thin-walled sac, pointed at its posterior end; its anterior end is directly continuous with the long efferent duct (*p*), which is often rather wide at its origin but tapers to a narrow anterior end. The terminal orifice is slightly bilabiate.

These organs receive blood through a special artery (fig. 2, *po*) which arises from the posterior aorta just back of the heart. After reaching the genital organ it divides into several branches; one going forward along the side of the efferent duct; one to the prostate glands and vesiculæ-seminales; one to the vas-deferens and adjacent parts.

Specimens taken in May, in the breeding season, have the efferent duct and the spermatophore-sac crowded with the spermatophores. In the spermatophore-sac, which is then much distended by them, they lie closely packed in a longitudinal position with their larger ends pointing somewhat outward toward the surface, and can be plainly seen through the transparent walls of the sac.

The spermatophores are slender, club-shaped, with the larger end rounded, tapering gradually to the smaller end, which is usually a little expanded at the tip and has a very small filament. They vary (in alcohol) from 8 to 10^{mm} in length and 4 to 5^{mm} in the greatest diameter. They contain a coiled rope of spermatozoa in the larger end and a complicated apparatus for automatically ejecting this rope in the smaller portion.

The "testicle" or spermary (*t*) is a compact, pale yellow, long, flattened organ, extending from the stomach (*s*) nearly to the end of the pen, in the posterior concavity of which it lies; a band of fibrous tissue, continuous with its sheath, extends from its posterior end into the hollow tip of the pen, to which it is attached. An arterial vessel, the spermatic artery (Pl. XL, fig. 2, *go*), which arises directly from the anterior edge of the heart, runs along the median dorsal line of the spermary and sends off numerous branches to the right and left (fig. 2, *t*). This artery is accompanied by a spermatic vein (*sv*), closely united to it.

Loligo brevis Blainville.

Loligo brevis Blainv., Journ. de Phys., March, 1823 (t. D'Orb.); Dict. des Sci. nat., vol. xxvii, p. 145, 1823.

D'Orbigny, Céphal. Acétab., p. 314, *Loligo*, pl. 13, figs. 4–6 (copied from Lesueur); pl. 15, figs. 1–3 (orig.); pl. 24, figs. 14–19 (orig.).

Tryon, Marine Conch., i, p. 142, pl. 52, figs. 143, 144 (after D'Orbigny).

Verrill, Trans. Conn. Acad., v, p. 343, 1881.

Loligo brevipinna Lesueur, Journ. Acad. Nat. Sci. Philad., vol. iii, p. 282 (with plate), 1824.

Tryon, Manual Conch., i, p. 142, pl. 51, figs. 128–130 (after Lesueur).

Plate XXI, figures 4–4c.

A small, short-bodied species, with short rounded caudal fins, very short upper arms, and large chromatophoric spots.

Body short, thick, well rounded, rather blunt posteriorly. Anterior

edge of mantle with a well-developed median dorsal lobe, and well-marked lateral angles. Fins broad transversely, short, less than half the length of the mantle; outer edges well rounded; posterior end very obtuse. Arms all short, the two upper pairs much shorter than the two lower, the dorsal pair very short, considerably shorter than the upper lateral ones; ventral and lower lateral arms nearly equal in length. The dorsal arms are strongly compressed, with a well-marked, thin, dorsal keel; those of the second pair squarish at base, without a keel; those of the third pair are strongly compressed, bent outward at the base, and furnished with a high median keel, starting from the base, but highest in the middle; ventral arms triangular at base, with a wide membrane on the upper angle, which expands at the base and connects them with the third pair; a narrower membrane runs along the ventral margins. Tentacular arms rather stout at base, compressed farther out, in extension about as long as the body; club well developed, about twice as broad as the rest of the arm; its dorsal keel thin, elevated, oblique, commencing at about the middle of the club and extending to the tip. The larger tentacular suckers are very regularly arranged in four rows of 8 to 10 each, the lateral ones being not very much smaller than the median ones. The distal part of the club is covered with four regular rows of small suckers, and there is a terminal group of smaller, smooth-rimmed ones. The largest median suckers (Plate XXXI, figs 4*b*, 4*c*) are broad, cup-shaped, rather larger than the largest suckers of the lateral arms; their horny rims are armed with regular, sharp, incurved teeth, smaller on the inner side of the sucker, but there are few or no small teeth, alternating with the larger ones. The lateral suckers are relatively large, deep cup-shaped, oblique, with very sharp incurved teeth on the outer margin. The membranous borders of the large suckers are covered with minute, sharp, chitinous scales.

The suckers of the short arms are very deep and oblique, cup-shaped; their rims are much the highest on the outer or distal side, where the edge is divided into several broad, bluntly rounded denticles, separated by narrow intervals.

The pen (Plate XXXI, fig. 4*a*) is short with a broad lanceolate blade; the narrow part of the shaft is short; a thin border, widening backward to the blade, commences about half way between the tip and the proper blade; the latter is broad and thin, marked with divergent lines; posterior end obtuse.

In the female there is no tubercle on the buccal membrane for the attachment of spermatophores. I have not seen the male, nor has any writer described it distinctively.*

* Professor Steenstrup, in a recent paper, (Sepiadarium og Idiosepius, < Vid. Selsk. Skr., 6 R., 1, 3, p. 242, note, 1881) has proposed to make this species the type of a new genus, *Lolliguncula*, because the female receives the spermatophores on the inner surface of the mantle,—a character that seems to be scarcely of generic value, unless it be reinforced by anatomical differences now unknown. Such characters may possibly exist in the unknown males.

The color is peculiar: it consists, on the body, in alcoholic specimens, of dark purplish chromatophores, everywhere pretty uniformly and regularly scattered, on a pale ground-color. When expanded these chromatophores are large and round; above the eyes they are so closely crowded as to form dark blotches; they also cover the outer surface of all the arms; underside of caudal fin white.

In alcohol, a medium-sized specimen measures from tip of tail to base of dorsal arms, 80mm; total length of mantle, 71mm; breadth of body, 22mm; breadth of caudal fin, 52mm; length of fin, 39mm; length of dorsal arms, from base, 17mm; of second pair, 23mm; of third pair, 31mm; of ventral arms 31mm; of tentacular arms, 46mm; of club, 22mm.

A larger female specimen, from Charlotte Harbor, Florida, measured, in length of mantle, 130mm; diameter of body, 36mm; length of dorsal arms, 45mm; of second pair, 55mm; of third pair, 65mm; of tentacular arms, 145mm.

This species appears to have an extensive distribution along the warmer parts of the Atlantic coasts of America. It was originally described by Blainville as from Brazil. D'Orbigny records it from Rio Janeiro. It ranges northward to Delaware Bay. It is common on our southern coasts, from South Carolina to Florida, and I have seen specimens from Mobile Bay, Alabama, and from Louisiana.

Loligo brevis.—Specimens examined.

Number.	Locality.	Collected by—	When collected.	Received from—	Specimens, number and sex.
641	Mobile, Ala	Dr. Nott	1857	Museum of Comparative Zoölogy.	3 ♀.
641	Charlotte Harbor, Fla			do	2 ♀.
	Hampton, Va	Dr. Marmion	1880	United States National Museum	1 ♀.
	Saint John's River, Fla.	S. F. Baird		do	1 ♀.
	Louisiana Coast	Geo. W. Dunbar's Sons	1881	do	2 ♀.

SEPIOTEUTHIS Blainv., 1823.

This genus closely resembles *Loligo*, in external characters. It is distinguished chiefly by having the fins extending nearly the whole length of the mantle. The body is stout and depressed, somewhat as in *Sepia*. The pen is thin and horny, lanceolate, nearly as in *Loligo*, but is often thickened near the margins.

There are, however, important differences in the visceral anatomy. The eggs are much larger and fewer than in *Loligo*, and the ovary is short and broad, at the posterior end of the body.

Sepioteuthis sepioidea D'Orb.

Loligo sepioidea Blainville, Dict. Sci. Nat., xxvii, p. 146, 1823.

Sepioteuthis triangulata Rang, Mag. de Zool., p. 73, pl. 98, 1837 (t. D'Orbigny).

Sepioteuthis sepioidea D'Orbigny, Céph. Acétab., p. 298, *Sepioteuthes*, pl. 7, figs. 6–11; Hist. l'Ile de Cuba, Moll., p. 34, 1853.

Sepioteuthis sepioidea D'Orb.—(Continued.)

Gray, Catal. Moll. Brit. Mus., i, p. 81, 1849.

Tryon, Man. Conch., i, p. 153, pl. 63, fig. 216. (Description copied from Gray; figure from D'Orbigny.)

Verrill, Trans. Conn. Acad., v, p. 345, 1881.

Body oblong, stout, depressed, tapering but little, obtuse posteriorly. The fins, together, have a long, rhomboidal form, broadest in the middle and rounded posteriorly; they commence a short distance (5 to 10^{mm}) from the anterior border of the mantle and extend to the posterior end; a narrow crest-like extension of the fins, around the posterior end of the body, unites them together. Buccal membrane with seven long, acute lobes, without suckers. Sessile arms rather slender, the third pair much the largest; the first very short and compressed. Suckers with broad rims, having long, slender teeth on the outer side and smaller ones on the inner. Tentacular club with four rows of large suckers, about twelve in each; the central ones have the rims strongly and regularly denticulated with slender, acute teeth; the marginal ones are but little smaller, with similar teeth on the outer edge. The pen is broad, lance-shaped; the blade is wide and thin, without any marginal thickenings.

The male has the left ventral arm hectocotylized by the enlargement and elongation of the stems of the suckers, in both rows, on the distal part of the arms, as in *Loligo;* but in this species the cups are entirely obsolete on many of the stems in both rows, the stems becoming long, conical, with acute tips. The large spermatophore-sac is filled with spermatophores in some of the specimens examined by me, and there is a saccular enlargement of the efferent sperm-duct or "penis" near the terminal orifice. These specimens have the larger part of the inner surface of the siphon covered with a soft, whitish, glandular-looking membrane, which is thrown into longitudinal, convoluted folds.

A large female, taken in July, has a short, thick ovary, and is distended by comparatively few very large eggs (5–6^{mm} in diameter), which have a strongly reticulated surface before reaching the glandular part of the duct. The oviduct is very large, with large glands, and its external orifice is large and surrounded by a broad and very complicated border. The accessory nidamental glands are also very large. The short ovary is restricted to the posterior part of the body. This specimen had spermatophores attached to and around a large elevated area on the lower part of the inner surface of the inner buccal membrane.

This species is widely distributed along the warmer parts of the American coast and throughout the West Indies, extending as far north, at least, as Bermuda, from whence I have a specimen collected by Mr. G. Brown Goode. It may, therefore, occasionally occur as far north as Cape Hatteras, but I have seen no specimens from our coast, north of Florida.

From the Museum of Comparative Zoology I have received two specimens from Cuba (Professor Poey); two large males, with spermato-

phores in the sac, taken at Key West by Dr. J. B. Holder and Captain Pickering; and a large female, with ripe eggs in the oviducts, and spermatophores on the buccal membrane, taken July, 1859, at Fort Jefferson, by Capt. D. P. Woodbury. Other localities are Martinique (Blainville, Rang); Cuba (D'Orbigny); Honduras (Gray).

Family SEPIOLIDÆ Keff.

Kefferstein, in Bronn, Thier-Reich, iii, p. 1443, 1866.
Gill, Arrangement of Families of Mollusca, p. 2, 1871.
Tryon, Man. Conch., i, pp. 102, 155, 1879.

Body, short, thick, blunt posteriorly. Eyes with lower lid free, upper adherent; sometimes free all around; pupils often circular. Fins separate, laterally attached near the middle of the body. Tentacular arms more or less retractile into large sacs. Pen little developed, not reaching the end of the mantle; sometimes absent. Siphon-valve small; no dorsal bridles. Dorsal arms usually hectocotylized in the male. Eggs large, few, not enclosed in capsules.

This family is related to *Loliginidæ*, but differs widely from the latter in the eye-lids, visceral anatomy, &c.

STOLOTEUTHIS Verrill, 1881.

Body short, stout, rounded posteriorly. Eyes with *free eyelids;* pupils round. Pen none. Arms united together by a broad web. Fins large, narrowed at base. Mantle united directly to the head by a large dorsal commissure; lateral connective cartilages of the mantle elongated, fitting into elongated, margined pits on the base of the siphon. Siphon with an internal valve. Tentacular club with small, long-pediceled suckers, in eight or more rows; rims not toothed.

The males and some of the females have some of the middle suckers of the second pair of arms much enlarged. In the male, the suckers at the base of both dorsal arms are larger and more crowded than in the female, and the web is more swollen at the sides.

Stoloteuthis leucoptera Verrill.—Butterfly Squid.

Sepiola leucoptera Verrill, Amer. Journ. Sci., vol. xvi, p. 378, 1878.
Tryon, Man. Conch., i, p. 158, 1879. (Description copied from preceding.)
Verrill, Amer. Journ. Sci., xix, p. 291, pl. 15, figs. 4 and 5, April, 1880; Trans. Conn. Acad., v, p. 347, pl. 31, figs. 4 and 5; pl. 54, fig. 4, June, 1881.
Stoloteuthis leucoptera Verrill, Trans. Conn. Acad., v, Oct., 1881.

Plate XXXVI, figures 1, 1*a*, 2.

Size moderate; the largest specimens observed are probably full-grown. Body short, thick, swollen, with the mantle smooth. Ventral surface, in the middle, with a large, somewhat flattened, brown, heart-shaped or shield-shaped area, bordered with blue, and surrounded, except in front, by a silvery white band, having a pearly or opalescent luster. Eyes large, with round pupils; lids free all around. Fins large,

thin, broadly rounded, in the living specimens nearly as long as the body; the posterior lobe reaches nearly to the end of the body; the anterior edge extends beyond the front of the mantle to the eye. The anterior edge of the mantle is prominent and emarginate beneath; laterally it recedes to a great extent; above it is broadly attached to the head. Sessile arms short, with a wide basal web, extending beyond the middle; upper ones shortest; third pair longest; suckers in two rows, except at tip of ventral arms of largest male, where they form four rows.

Tentacular arms slender, thickened at base, tapering, extending back as far as the end of the body; club scarcely as wide as the arm, with a free crest at its base, above, curled in preserved specimens; the suckers are numerous and very minute, arranged in many rows.

Upper surface of the body is opalescent in some lights, thickly spotted with orange-brown, spots most numerous in the middle line and extending to the upper surface of the head; some also occur on the outer surfaces of the arms; anterior part of the head white; fins, arms and extremity of body translucent bluish white, with a thick, transparent, outer integument; upper surface of the eyes opalescent, with silvery blue and red tints; head, below the eyes, silvery white; above the eyes, blue.

The largest specimen (♂), taken in 1879 (Plate XXXVI, fig. 1), when living had the head, above, in front of the eyes, whitish, with few chromatophores; back and the base of the fins thickly spotted with brown; posterior part of the back with an emerald-green iridescence. Sides of the body, below the fins, and posterior end of the body, silvery white. A large, shield-shaped, ventral area of brown, with a bright blue iridescence, and bordered with a band of brilliant blue, occupies most of the lower surface. Fins, transparent whitish, except at base. Lower side of head, siphon, and outer bases of the arms, light brown. Eyes blue above, green below.

Length of the original type-specimen (♀), to the base of the arms, 14^{mm}, in alcohol; of mantle above, 8^{mm}; breadth, 7^{mm}; breadth across fins, 16^{mm}. The larger specimen, of 1879, is 31^{mm} (1.25 inch) long, from the end of the body to the bases of the arms; breadth of body, 25^{mm} (1 inch); length of arms, 19^{mm} (.75 inch). The largest specimen is a male.

The males (fig. 5) of this species, and some of the females, have a group of two or three decidedly and abruptly larger suckers on the middle of the second pair of arms (Plate XXXVI, fig. 1*a*); other females, of equal size, have no such enlarged suckers; in the male, additional suckers along the middle portion of the lateral arms are also distinctly larger than on the other arms. The only evidence of true hectocotylization is the presence of larger and more crowded suckers at the base of both dorsal arms of the male. This species is an exceedingly beautiful one, when living, owing to the elegance and brilliancy of its colors and the gracefulness of its movements. In swimming it moves its fins in a manner analogous to

the motion of the wings of a butterfly. This fact, and its bright colors, suggested the English name that I have applied to it.

Three specimens, two very young, were taken by the writer and party, of the United States Fish Commission, in the trawl-net, 30 miles east from Cape Ann, Mass., in 110 fathoms, August, 1878. Two large specimens were taken by us off Cape Cod in 94 and 122 fathoms, with the bottom temperature 41° F., August and September, 1879. Recently we have taken it in deeper water (182–388 fathoms) about 100 miles south of Martha's Vineyard. It was, in each case, associated with *Octopus Bairdii* and *Rossia sublevis*.

Station.	Locality.	Fath.	When collected.	Received from—	Specimens, number and sex.
194	Gulf of Maine	110	Aug. 31, 1878	United States Fish Commission	3 j.
303	Off Cape Cod	122	Aug. 21, 1879	do	1 ♂
342	do	94	Sept. 10, 1879	do	1l. ♀
947	Off Martha's Vineyard	312	Aug. 9, 1881	do	1l. ♀; 1 j.
952	do	388	Aug. 24, 1881	do	1l. ♀
998	do	302	Sept. 8, 1881	do	1l. ♂; 1l. ♀
999	do	266	do	do	1 ♀
1026	do	182	do	do	3 j.

ROSSIA Owen.

Rossia Owen, Trans. Zool. Soc., London, 1828 (t. Gray).
Owen, in J. Ross, Second Arctic Voyage, Appendix, p. xcii, pl. 100, 1835.
D'Orbigny, Céphal. Acétab., p. 242.
Gray, Catal. Moll. Brit. Mus., i, p. 88, 1849.

Mantle-edge free from the head, dorsally, with a small median angle; it adheres to the head by a longitudinal connective cartilage having three ridges, fitting into three grooves, which form an ovate or horse-shoe-shaped cartilage on the back of the head; two elongated, simple, cartilaginous ridges, one on each side, also fit into ovate pits on the base of the siphon. A free eyelid is developed beneath the eye. Pupils indented above. An aquiferous pore, on each side, between the third and fourth pairs of arms. No olfactory crests. Tentacular arms more or less retractile into cavities below the eyes; club well-developed, usually with numerous, nearly equal, minute suckers, in about eight rows; rims not toothed; borders scaled.

The males differ from the females in having larger suckers on the middle of the lateral arms; both dorsal arms are slightly hectocotylized.

Rossia Hyatti Verrill.—(Hyatt's bob-tailed squid.)
Verrill, Amer. Journ. Sci., vol. xvi, p. 208, 1878.
Tryon, Man. Conch., i, p. 160, 1879. (Description compiled from preceding.)
Verrill, Amer. Jour. Sci., xix, p. 291, pl. 15, figs. 1 and 2, April, 1880; Trans. Conn. Acad., v., p. 351, pl. 27, figs. 8, 9; pl. 30, fig. 1; pl. 31, figs. 1, 2; pl. 46, fig. 5, 1881.

Plate XXXV, figures 2, 5, 6. Plate XXXVI, figures 3–6. Plate XXXVII, figure 1.

Body subcylindrical, usually broader posteriorly; in preserved specimens variable in form according to contraction. Dorsal surface cov-

ered with small, conical, scattered, whitish papillæ, which are also found on the upper and lateral surfaces of the head and the bases of the arms; those around the eyes largest; one on the mantle, in the median line, near the front edge, is often elongated. Front border of mantle sinuous, slightly advancing in the middle, above. Fins moderately large, nearly semi-circular, attached from the posterior end for about four-fifths the whole length, the front end having a small, rounded, free lobe. The distance from the posterior junction of the fins to the end of the body is less than that from the anterior junction to the edge of the mantle, the center of the fin being at about the middle of the body. Siphon elongated, conical, with a small opening. Head depressed, more than half the length of the body. Eyes large, the lower eyelid prominent, but not much thickened. Sessile arms short, united at their bases by a short web, which is absent between the ventral arms; the dorsals are shortest; the third pair the longest and largest; the second pair and ventrals about equal in length. Suckers (Pl. XXXVI, fig. 5, *a*), numerous, subglobular, not very small, the margin bordered with several rows of minute scales; near the base of the arms they are biserial, there being usually four to six thus arranged in each row; then, along the rest of the length of the arms, they become more crowded and form about four rows, those in the two middle rows alternating with those in the marginal rows; toward the tip they become very small and crowded, especially on the dorsal and ventral arms. The number of suckers varies with age, but on one of the original specimens they were as follows: on each dorsal arm, sixty; on one of the second pair, fifty-five; of third pair, fifty-three; of ventral, sixty-five. In this specimen (♀), the third arm of the right side and the ventral arm of the left side were abruptly terminated (accidentally), while the others were tapered to acute points.

The tentacular arms, in preserved specimens, will extend back to the posterior end of the body; the naked portion is smooth, somewhat triquetral, with the outer side convex and the angles rounded; terminal portion widening, rather abruptly, long ovate-lanceolate, curved and gradually tapered to the tip; the sucker-bearing portion is bordered by a wide membrane on the upper, and a narrow one on the lower margin; the suckers (Plate XXXVI, fig. 5, *b*, *c*) are very small, sub-globular, crowded in about eight to ten rows in the widest portion.

The males (Pl. XXXVI, fig. 6) differ from the females in the relatively greater size of the suckers on the middle of the lateral and ventral arms, those toward the tips becoming abruptly smaller, while in the female they decrease more gradually.

Color, pinkish, thickly spotted with purplish brown above, paler and more sparsely spotted beneath and on the outside of the long arms; the inner surfaces of the arms and front edge of the mantle are pale.

Length, of a medium-sized specimen, from bases of the arms to the posterior end of the body, 40^{mm}; of body, 25; of head, 15; breadth of body, 17; of head, 17; length of fins, 15; of insertion, 11; breadth of

a fin, 8; front of fin to edge of mantle, 5; length of the free portion of the dorsal arms, 12.5; of second pair, 15; of third pair, 18; of ventrals, 13; of tentacular arms, 40; breadth of dorsal arms, at base, 3.5; of second pair, 3.5; of third pair, 4; of ventrals, 3.5; of tentacular arms, at base, 2; at expanded portion, 3.5; length of latter, 10.5; diameter of largest suckers of sessile arms, 0.9; length of free portion of siphon, 7mm.

This species has been taken in numerous localities, by the dredging parties of the U. S. Fish Commission, in 1877, 1878, and 1879, off Cape Cod; in Mass. Bay, 40–50 fathoms; off Cape Ann, in the Gulf of Maine, 50–100 fathoms; off Cape Sable, N. S., 88–92 fathoms; off Halifax, N. S., 57–100 fathoms, on a fine, compact, sand and mud bottom. It occurs in 40–100 fathoms. It has also been received through the Gloucester halibut fishermen, from the Banks, off Nova Scotia and Newfoundland.

One specimen (lot 241), presented by Capt. Chris. Olsen and crew, of the schooner "William Thompson," was taken in 60 fathoms, N. lat. 44° 20′, W. long. 59°. Another (lot 372), which was presented by Capt. C. D. Murphy and crew, of the schooner "Alice M. Williams," was taken in 7 fathoms, off Miquelon Island.

The relatively large eggs (Pl. XXXV, fig. 5) are laid in August and September, in small clusters, slightly attached together, in the large oscules or cavities of several species of sponges.

It is frequently associated with *Octopus Bairdii* V, and the following species.

This species has a strong general resemblance to *R. glaucopis* Lovén, as figured in the admirable work of G. O. Sars, but the latter has shorter lateral arms, and the suckers of the sessile arms are in two rows, while they are four-rowed in our species.

Rossia Hyatti.—Specimens examined.

Station.	Locality.	Fath.	Bottom.	When collected.	Received from—	Specimens, number and sex.
				1877.		
30, 31	Off Salem, Mass	48	Mud	Aug. 13	U. S. Fish Com.	2 j.
33	Off Cape Ann, 13 miles	90	do	Aug. 14	do	1 l. ♂.
42–46	Off Cape Sable, N. S., 30 miles.	88–90	Sandy mud	Aug. 21	do	1 ♂: 1 ♀: 3 j.
48	Off Cape Sable, N. S., 20 miles.	59	Rocky	Aug. 21	do	1 j. ♀.
85–86	Off Halifax, N. S., 26 miles.	101	Fine sand	Sept. 6	do	2 l. ♀.
	Gulf of Maine and Massachusetts Bay.					
				1878.		
130	Off Cape Ann, 14 miles	49	Mud	July 23	do	3 j.
156	Off Gloucester, Mass., 8 miles.	42	Sandy mud	Aug. 15	do	2 j.
163	Off Cape Ann, 6¼ miles	73	Fine sand	Aug. 16	do	1 ♂: 2 j. ♀.
164	Off Cape Ann, 7 miles	75	do	Aug. 16	do	1 ♀.
181	Off Gloucester, Mass	45	Mud	Aug. 29	do	4 ♀.
184	Off Gloucester, Mass., 5 miles.	45	do	Aug. 29	do	1 j.
211	Off Cape Ann, 6 miles	60	Soft mud	Sept. 17	do	1 j. ♂: 1 j. ♀.
214	Off Cape Ann, 7 miles	57	Fine muddy sand	Sept. 17	do	1 ♀.
217	Off Cape Ann, 6 miles	45	Soft mud	Sept. 18	do	1 l. ♂.
218	do	45	do	Sept. 18	do	1 l. ♀: 1 j.

Rossia Hyatti—Continued.

Station.	Locality.	Fath.	Bottom.	When collected.	Received from—	Specimens, number and sex.
	Gulf of Maine and Massachusetts Bay—Continued.			1878.		
223	South of Cape Ann, 7 miles.	47	Soft mud	Sept. 24	U. S. Fish Com.	1 ♂.
234	Off Gloucester, Mass., 5½ miles.	43	do	Sept. 24	do	1 ♀.
238	Off Gloucester, Mass., 4½ miles.	43	do	Sept. 26	do	2 j.
				1879.		
264	Off Cape Cod, 15 miles	80	Blue mud	July 29	do	1 l. ♂.
276	Off Cape Cod, 7½ miles	47	do	Aug. 1	do	1 l. ♀.
324	Off Cape Cod, 11 miles	45	Fine sand	Sept. 1	do	1 l. ♂.
364	Off Cape Cod, 15 miles	70	do	Sept. 18	do	1 l. ♀ : 3 j. ♀.
372	Off Chatham, Mass., 21 miles.	70	do	Sept. 19	do	1 ♂.
Lot.	*Gloucester fisheries.*					
241	North latitude 44° 20′, west longitude 59°.	60		Dec., '78	do	1 j.
372	Off Miquelon Island	7		July, '79	do	1 j.
39 Gl.	Off Gloucester, in cod				do	1 l. ♀.

Rossia sublevis Verrill.—(Smooth bob-tailed squid.)

Rossia sublevis Verrill, Amer. Jour. Sci., vol. xvi, p. 209, 1878.

Tryon, Man. Conch., i, p. 160, 1879. (Description compiled from preceding.)

Verrill, Amer. Journ. Sci., xix, p. 291, pl. 15, fig. 3, Apr., 1880; Bulletin Mus. Comp. Zool., viii, p, 104, pl. 3, figs. 2–4; pl. 7, fig. 4, 1881; Trans. Conn. Acad., v, p. 354, pl. 30, fig. 2; pl. 31, fig. 3; pl. 46, fig. 4; pl. 47, figs. 2–4, 1881.

Plate XXXIV, figures 2–6. Plate XXXVII, figure 2.

Larger and relatively stouter than *Rossia hyatti*, with the fins larger and placed farther forward, the front edge of the large, free lobe reaching nearly to the edge of the mantle. Head large and broad; eyes large. Sessile arms more slender and less unequal in size than in the preceding, and with the suckers in two regular rows throughout the whole length. Anterior edge of the mantle scarcely sinuous, advancing but little dorsally. Upper surface of the body and head nearly smooth, but in the larger specimens, especially in the males, usually with a few very small whitish papillæ, most numerous near the front edge of the mantle. Color, nearly as in the preceding species. The male differs from the female in having larger suckers on the lateral arms of both pairs (Plate XXXIV, fig. 6), and to a less extent on the ventral arms.

The large suckers are oblong, with a groove or constriction around the middle, the part below the groove larger than that above it; the aperture is small, ovate, with a smooth rim; their pedicels are short and laterally attached. In the female the corresponding suckers are not only smaller, but are differently shaped, the basal portion being smaller than the upper portion. The suckers of the tentacular arms are very numerous, minute, shallow, cup-shaped, with oblique rims and slender pedicels; they are nearly equal and appear to form 8 to 12 rows.

Young specimens, with the mantle less than 12mm in length, can scarcely be distinguished sexually, by external characters. Such specimens are not easily distinguished from the young of *Rossia Hyatti*, of similar size.

One of the original specimens (♀) measured, from the base of the arms to the end of the body, 46mm; length of body, 31; of head, 15; breadth of body, 22; of head, 23; length of fins, 20; of their insertion, 16; breadth of fins, 10; front edge of fin to edge of mantle, 2.5; length of free portion of dorsal arms, 16; of second pair, 17; of third pair, 20; of ventrals, 15; of tentacular arms, 25; breadth of dorsal arms at base, 3; of second pair, 3; of third, 3.5; of ventrals, 3.5; of tentacular arms, 3.5; of the terminal portion, 3.75; its length, 10; diameter of largest suckers of sessile arms, .8; length of free portion of siphon, 7mm.

The pen is but little developed, small and thin, much shorter than the mantle. The shaft is narrow; the blade increases in breadth rather abruptly, and is somewhat shorter than the shaft; its posterior portion is very thin, with the edge ill-defined.

One of the specimens (No. 16), taken by Mr. Agassiz in 257 fathoms, is a young female differing somewhat from the others in having the arms shorter, with the suckers more crowded, so that they apparently form more than two rows. Possibly this should be referred to *R. Hyatti* Verrill. Its back is smooth. All three specimens from this same region differ somewhat from those taken farther north, in shallower water, in having larger eyes and shorter and stouter arms.

This has been taken by the dredging parties of the U. S. Fish Commission, in the trawl-net, at various localities, in 1877, 1878, and 1879, in 45 to 110 fathoms, off Massachusetts Bay, in Massachusetts Bay, off Cape Cod, off Cape Sable, N. S., and off Halifax. It has been brought in by the fishermen of Gloucester, Mass., from the banks off Nova Scotia and Newfoundland. It was also trawled in some numbers, and of both sexes, by the U. S. Fish Commission, on the "Fish Hawk," in 1880, off Newport, R. I., in 155 to 365 fathoms; and in November, 1880, by Lieut. Z. L. Tanner, on the "Fish Hawk," off the mouth of Chesapeake Bay, in 157 fathoms; and by Mr. Agassiz, on the "Blake," in 233–260 fathoms, and as far south as lat. 32° 33′ 15″. It has also been dredged, in 1881, by the U. S. Fish Commission, at several stations, about 100 miles southward of Martha's Vineyard, in 160–458 fathoms (fifty-two specimens). The eggs, which are like those of *R. Hyatti*, were taken at 895, 897, 939, 1033.

This species very closely resembles the *Rossia glaucopis* Lovén, of Northern Europe, as figured by G. O. Sars. The latter is, however, more papillose, and has smaller eyes and head, if correctly figured. Some of the specimens taken this year resemble Sar's figure more than any of those previously observed. It is possible, therefore, that a larger series of European specimens would show that they are of the same species.

Measurements of Rossia Hyatti and R. sublevis, in millimeters.

	R. Hyatti.	R. sublevis.
Length from base of arms	40	46
Length of body	25	31
Length of head	15	15
Breadth of body	17	22
Breadth of head	17	23
Length of fin	15	20
Length of insertion	11	16
Breadth of fin	8	10
Front edge of fin to edge of mantle	5	2.5
Length of free portion of dorsal arms	12.5	16
Length of free portion of second pair	15	17
Length of free portion of third pair	18	20
Length of free portion of ventral arms	13	15
Length of free portion of tentacular arms	40	25
Breadth of dorsal arms	3.5	3
Breadth of second pair	3.5	3
Breadth of third pair	4	3.5
Breadth of ventral arms	3.5	3.5
Breadth of tentacular arms	2	3.5
Breadth of terminal portion	3.5	3.75
Length of terminal portion	10.5	10
Diameter of largest suckers	.8	.8
Length of free portion of siphon	7	6

Rossia sublevis.—Specimens examined.

Station.	Locality.	Fath.	Bottom.	When collected.	Received from—	Specimens, number and sex.
	United States Fish Commission.			1877.		
84	Off Halifax, N. S., 26 miles	101	Fine sand	Sept. 6	U. S. F. C.	1 l. ♀ : 1 j.
85, 86	do	101	do	Sept. 6	do	1 ♂ : 1 j. ♀
				1878.		
161	Off Cape Ann, 6 miles	54		Aug. 6	do	1 l. ♂
194	Off Cape Ann, 33 miles	110	Mnddy	Aug. 31	do	
				1879.		
264	Off Cape Cod, 15 miles	80	Blue mud	July 29	do	1 ♂ : 1 l. ♀ : 3 j.
324	Off Cape Cod, 11 miles	45	Sand	Sept. 1	do	1 l. ♂
364	Off Cape Cod, 15 miles	70	do	Sept. 18	do	1 j.
	United States Fish Commission. Off Newport, R. I.			1880.		
868	North latitude 40° 2′ 18″, west longitude 70° 23′ 6′.	192	Sandy mud	Sept. 4	do	1 ♂ : 5 ♀
870	North latitude 40° 2′ 36″, west longitnde 70° 22′ 58″.	155	do	Sept. 4	do	1 ♂ : 1 ♀
880	North latitnde 39° 48′ 30″, west longitude 70° 54′.	252	do	Sept. 13	do	1 l. ♂
893	North latitude 39° 52′ 20″, west longitude 70° 58′.	372	Mud	Oct. 2	do	1 j.
894	North latitnde 39° 53′, west longitude 70° 58′ 30″.	365	do	Oct. 2	do	1 l. ♂ : 1 j. ♀
895	North latitnde 39° 56′ 30″, west longitnde 70° 59′ 45″.	238	do	Oct. 2	do	1 l. ♂ : 1 l. ♀ : 5 j.
897	Off Chesapeake Bay	157		Nov. 16	do	1 l. ♂ (eggs).
	Blake Expedition, United States Coast Survey.					
310	North latitude 39° 59′ 16″, west longitude 70° 18′ 30″.	260		1880.	A. Agassiz	1 ♀ ad.
320	North latitnde 32° 33′ 15″, west longitude 77° 30′ 10″.	257		1880.	do	1 ♀ ad.
321	North latitnde 32° 43′ 25″, west longitude 77° 20′ 30″.	233		1880.	do	1 ♀ j. ?
Lot.	*Gloucester fisheries.*					
265	North latitude 42° 49′, west longitnde 62° 57′.	250		Jan., '79	U. S. F. C.	1 j.

Rossia sublevis—Continued.

Station.	Locality.	Fath.	Bottom.	When collected.	Received from—	Specimens, number and sex.
	United States Fish Commission. Off Martha's Vineyard.			1881.		
924	S. ½ W. 83½ m. from Gay Head.	160		July 16	U. S. F. C.	1 l. ♀: eggs.
925	S. ½ W. 86 m. from Gay Head..	224			....do	2 l. ♂
939	S. by E. ½ E. 98 m. from Gay Head.	258		Aug. 4	....do	19: eggs.
943	SSW. 83 m. from Gay Head...	153		Aug. 9	....do	1
945	S. by W. ¾ W. 84½ m. from Gay Head.	202		Aug. 9	....do	1 l. ♂: 4 ♀
946	S. by W. ¾ W. 87½ m. from Gay Head.	241		Aug. 9	....do	2 ♂: 3 ♀
947	S. by W. ¾ W. 89 m. from Gay Head.	312		Aug. 9	... do	6
951	S. 85 m. from Gay Head.....	219		Aug. 23	....do	5 ♂: 2 ♀
952	S. ½ E. 87½ m. from Gay Head.	388		Aug. 23	....do	2 ♀
997	SSW. ¼ W. 103½ m. from Gay Head.	335		Sept. 8	....do	1 ♂
1025	SSW. ¼ W. 95 m. from Gay Head.	216		Sept. 8	....do	3 ♀
1026	SSW. ¼ W. 93½ m. from Gay Head.	182		Sept. 8	....do	2 ♀
1028	SSE. ¾ E. 108½ m. from Gay Head.	410		Sept. 14	....do	1 l. ♂
1029	SSE. ¾ E. 109½ m. from Gay Head.	458		Sept. 14	....do	1 j.
1032	SSE. ½ E. 107 m. from Gay Head.	208		Sept. 14	....do	5
1033	SSE. ½ E. 106 m. from Gay Head.	183		Sept. 14	....do	1 j.: eggs.
1045	Off Delaware Bay.....	312	Mud.....	Oct. 10	....do	3 l. ♂: 1 j.

Rossia megaptera Verrill.

Trans. Conn. Acad., v, p. 349, pl. 38, fig. 1, pl. 46, fig. 6, June, 1881.

Plate XXXV, figures 3, 4.

Body short, broad, depressed, covered with a soft flabby integument, which forms a loose border posteriorly; the front edge of the mantle extends forward dorsally into a prominent angle, but recedes very much ventrally. Fins very large and broad; their anterior insertions being but little back of the antero-lateral edge of the mantle, and their posterior insertion close to the end of the body; the free borders of the fins are thin and undulated, extending forward anteriorly beyond the edge of the mantle, while the length, from base to outer edge, is about equal to the breadth of the back between the bases of the fins.

Head very large and broad, the width exceeding that of the body. Eyes very large and prominent; lower eyelids well developed but not much thickened. Tentacles remarkably long and slender, in extension about twice as long as the head and body together. The tentacular club is somewhat thicker than the rest of the arm, rather long, narrow, tapering to the tip, and covered with numerous minute, nearly globular, slender pedicelled suckers, arranged in many rows. (Plate XXXV, fig. 4, *a*, *b*, *c*.)

Sessile arms of moderate length; rounded, very slender at tip; the 1st, 2d, and 3d pairs are successively longer, while the ventral pair is about equal to the 1st. Suckers rather small, nearly globular, arranged in two rows on all the arms (fig. 4, *a*). The suckers are all similar, but are a little larger on the 3d pair of arms. The margin is sur-

rounded by small scales, in many rows; the marginal scales are larger, forming a circle of denticles.

Color purplish brown with rather large chocolate-brown chromatophores; outer portion of fins pale, thin and translucent; edge of mantle, siphon, under side of head and arms, and greater part of tentacular arms whitish, with only minute chromatophores.

Measurements of Rossia megaptera.

	Millimeters.	Inches.
Length, end of body to dorsal edge of mantle, exclusive of membrane	32	1.25
Length, end of body to ventral edge of mantle	24	.95
Length, end of body to base of dorsal arms	57	2.25
Length, end of body to tip of dorsal arms	86	3.40
Length, end of body to tip of second pair	95	3.75
Length, end of body to tip of third pair	103	4.08
Length, end of body to tip of fourth pair	95	3.75
Length, end of body to tip of tentacular arms	188	7.45
Breadth of body and fins together	63	2.50
Breadth of body between bases of fins	22	.85
Breadth of body, beneath fins, exclusive of membrane	28	1.10
Breadth of head across eyes	36	1.40
Breadth of fins antero-posteriorly	27	1.08
Length of fins, base to edge (outer)	22	.85
Diameter of eyes	19	.75
Diameter of large suckers of lateral arms	1.50	.06
Diameter of large suckers of club	.25	.01
Breadth of club	4	.16
Length of club	24	.95

Southern coast of Newfoundland, in 150 fathoms, Capt. K. Markuson and crew, schooner "Notice," June, 1880.

This species is remarkable for the great size of the fins and eyes, and for the length of the tentacular arms. It appears to be a species specially adapted for inhabiting greater depths than the species hitherto discovered. It has the same soft, flabby integument observed in *Octopus lentus* and *Stauroteuthis syrtensis*, found at similar depths. But the looseness of the skin may be due in part to the condition of the specimen when preserved. The tentacular suckers are unusually small.

HETEROTEUTHIS Gray (revised.)

Heteroteuthis (sub-genus) Gray, Catal. Moll. Brit. Mus., i, p. 90, 1849.
Verrill, Trans. Conn. Acad., v, p. 357, June, 1881.

The body is short, thick, rounded posteriorly. Fins large and lateral. Head and eyes large. The anterior border of the mantle-edge is free, dorsally. Pen shorter than the mantle, narrow anteriorly; posterior blade small, slightly expanded laterally. Club of the tentacular arms well developed, with numerous suckers, in many rows, those in the upper marginal rows decidedly larger than the rest; the edge of the aperture is denticulated by small acute scales. Middle suckers of the lateral and ventral arms distinctly larger in the female; in the male, abruptly very much larger than the others. In the male, the left dorsal arm is hectocotylized by having much smaller and more numerous suckers, arranged in four rows, and by the development of a marginal membrane.

Heteroteuthis tenera Verrill.

Amer. Journ. Sci., xx, p. 392, November, 1880; Proc. Nat. Mus., iii, p. 360, 1880; Bulletin Mus. Comp. Zool., xiii, p. 103, pl. 3, figs 5–5*b*; pl. 7, figs. 2–2*d*, 3–3*b*, 1881; Trans. Conn. Acad., v, p. 357, pl. 46, figs. 2–2*d*, 3–3*b*; pl. 47, figs. 5–5*b*, 1881.

Plate XXXIII. Plate XXXIV, figure 1.

A small and delicate species, very soft, translucent, and delicately colored when living.

Body short, cylindrical, scarcely twice as long as broad, posteriorly usually round, but in strongly contracted, preserved specimens, often narrowed and even obtusely pointed; front edge of mantle sometimes with a dorsal angle extending somewhat forward over the neck, but usually emarginate in alcoholic specimens. Fins very large, thin, longer than broad, the outer edge broadly rounded, the anterior edge extending forward quite as far as the edge of the mantle, and considerably beyond the insertion of the fin, which is itself well forward. The length of the fin is about two-thirds that of the body; the base or insertion of the fin equals about one-half the body-length; the breadth of the fin is greater than one-half the breadth of the body. Head large, rounded, with large and prominent eyes; lower eyelids free, slightly thickened; pupils indented above. Arms rather small, unequal, the dorsal ones considerably shorter and smaller than the others, the second pair longest.

In the male, the left dorsal arm is greatly modified, and very different from its mate; lateral and ventral arms are subequal. In both sexes, and even in the young, the suckers along the middle of the four lateral and two ventral arms are distinctly larger than the rest, but in the larger males this disparity becomes very remarkable, the middle suckers (Plate XXXIII, figs. 1, 1*a*, 1*b*, 3) becoming greatly enlarged and swollen, so that eight to ten of the largest are often six or eight times as broad as the proximal and distal ones; they are deep, laterally attached, with a raised band round the middle, and a very small round aperture, furnished with a smooth rim. In the female (Plate XXXIV, fig. 1) the corresponding suckers, on the lateral arms, are about twice as broad as the rest. The suckers are in two regular rows, on the lateral and ventral arms, in both sexes, except at the tip, where they form four rows.

In the male, the left dorsal arm becomes thickened, and larger from front to back, and is usually curled backward (Plate XXXIII, figs. 1–3); its suckers become smaller and much more numerous than on the right arm, being arranged in four crowded rows, except near the base, where there are but two; the sucker-stalks also become stout and cylindrical, or tapered, their diameter equaling that of the suckers. The right arm remains normal, with two alternating rows of suckers, regularly decreasing to the tip, as in both the dorsal arms of the female.

Tentacular arms long, slender, extensible; club distinctly enlarged, usually curled in preserved examples. The suckers on the club are numerous, unequal, arranged in about eight close rows; those forming the two or three rows next the upper margin are much larger than the rest,

being three or four times as broad, and have rows of small scale-like denticles around the rims. (Plate XXXIII, figs. 2*a*, 3*a*, 3*b*.)

Pen small and very thin, soft, and delicate. It is angularly pointed or pen-shaped anteriorly, the shaft narrowing backward; a thin lanceolate expansion, or margin, extends along nearly the posterior half (fig. 2*b*).

Upper jaw with a sharp, strongly incurved beak, without a notch at its base. Lower jaw with the tip of the beak strongly incurved, and with a broad, but prominent, rounded lobe on the middle of its cutting edges (fig. 2, *a*, *b*).

Odontophore with simple, acute-triangular median teeth; inner laterals simple, nearly of the same size and shape as the median, except at base; outer laterals much longer, strongly curved forward (fig. 2*c*, 2*d*).

Color, in life, pale and translucent, with scattered rosy chromatophores. In the alcoholic specimens, the general color of body, head, and arms is reddish, thickly spotted with rather large chromatophores, which also exist on the inner surface of the arms between the suckers, and to some extent on the tentacular arms and bases of the fins; outer part of fins translucent white; anterior edge of mantle with a white border.

Length of body 25 to 30 millimeters.

Twenty-seven specimens of this species were obtained, by Mr. A. Agassiz, on the "Blake," in 1880, from six stations, ranging in depth from 71 to 233 fathoms. It was taken, later in the season, in great abundance, by the U. S. Fish Commission, off Newport, R. I., in 65 to 252 fathoms; and off the mouth of Chesapeake Bay, in November, by Lieut. Z. L. Tanner, on the "Fish Hawk," in 18 to 57 fathoms. In 1881 it has also been dredged, at several stations, off Martha's Vineyard, in 45 to 182 fathoms.

It is easily distinguished from the species of *Rossia* by the large size of the suckers along the middle of the lateral arms; by the inequality of the suckers on the tentacular clubs; and by the peculiar hectocotylized condition of the left dorsal arm of the male. The existence of large chromatophores on the inner surfaces of the arms, between the suckers, is also a good diagnostic mark, by which to distinguish it from all our species of *Rossia*, which have the corresponding parts whitish, or with few and very small chromatophores.

The eggs of this species, containing, in several instances, embryos so far developed as to permit accurate identification, have been taken in August and September, by the U. S. Fish Commission, at many of the stations where the adults were obtained. They were especially numerous at stations 865–867, 872–874, in 1880; and at stations 922, 940, 949, in 1881. These eggs are attached to the surface of ascidians, worm-tubes, skate's eggs, dead shells, etc., singly, but placed side by side, in smaller or larger groups. They are about 3^{mm} in diameter, pearly white, and nearly round, but are slightly flattened where attached, and have a small, conical eminence, on the upper side.

Heteroteuthis tenera.—Specimens examined.

No.	Station.	Locality.	Fath.	When received.	Specimens, number and sex.
		United States Fish Commission. Off Martha's Vineyard.		1880.	
	865	North latitude 40° 05′, west longitude 70° 23′	65	Sept. 4	3 ♂ : 7 ♀ : eggs.
	866	North latitude 40° 05′ 18″, west longitude 70° 22′ 18″	65	Sept. 4	3 ♂ : 6 ♀ : eggs.
	867	North latitude 40° 05′ 42″, west longitude 70° 22′ 06″	64	Sept. 4	4 ♂ : 10 ♀ : eggs.
	869	North latitude 40° 02′ 18″, west longitude 70° 23′ 06″	192	Sept. 4	20 + ♂ & ♀
	870	North latitude 40° 02′ 36″, west longitude 70° 22′ 58″	155	Sept. 4	15 ♂ : 17 ♀
	871	North latitude 40° 02′ 54″, west longitude 70° 23″ 40″	115	Sept. 4	18 ♂ : 11 ♀ : 32 juv.
	872	North latitude 40° 05′ 39″, west longitude 70° 23′ 52″	86	Sept. 4	1 ♂ : 2 ♀ : eggs.
		Off Newport, R. I.		1880.	
	873	North latitude 40° 02′, west longitude 70° 57′	100	Sept. 13	5 ♂ : 1 ♀ : eggs.
	874	North latitude 40° 00′, west longitude 70° 57′	85	Sept. 13	10 ♂ : 6 ♀ : eggs.
	875	North latitude 39° 57′, west longitude 70° 57′ 30″	126	Sept. 13	1 ♂
	876	North latitude 39° 57′, west longitude 70° 56′	120	Sept. 13	8 ♂ : 6 ♀
	877	North latitude 39° 56′, west longitude 70° 54′ 18″	126	Sept. 13	6 ♂ : 4 ♀
	878	North latitude 39° 55′, west longitude 70° 54′ 15″	142½	Sept. 13	1 ♂ : 1 ♀
	879	North latitude 39° 49′ 30″, west longitude 70° 54′	225	Sept. 13	6
	880	North latitude 39° 48′ 30″, west longitude 70° 54′	252	Sept. 13	2 ♂
		Off Chesapeake Bay.			
	899	North latitude 37° 22′, west longitude 74° 29′	57½	Nov. 16	3 ♂ : 2 ♀
	900	North latitude 37° 19′, west longitude 74° 41′	31	Nov. 16	1 juv.
	901	North latitude 37° 10′, west longitude 75° 08′	18	Nov. 16	21 ♂ : 3 ♀
		Blake Expedition, U. S. Coast Survey.			
17, 18	313	Off Charleston, S. C	75	1880	7 ♂ : 5 ♀
19	314	North latitude 32° 24′, west longitude 78° 44′	142	1880	2 ♂ : 1 ♀
20	316	North latitude 32° 7′, west longitude 78° 37′ 30″	229	1880	1 ♀ juv.
21	321	North latitude 32° 43′ 25″, west longitude 77° 20′ 30″	233	1880	5 ♀
22	327	North latitude 34° 00′ 30″, west longitude 76° 10′ 30″	178	1880	1 ♂ : 3 ♀
23	345	North latitude 40° 10′ 15, west longitude 70° 4′ 30″	71	1880	2 ♀ juv.
		United States Fish Commission. Off Martha's Vineyard.		1881.	
	918	S. ½ W. 61 m. from Gay Head	45	July 16	1 ♂ : 1 ♀
	919	S. ½ W. 65 m. from Gay Head	51½	July 16	4 ♂
	920	S. ½ W. 68½ m. from Gay Head	61	July 16	3 ♂ : 5 ♀
	921	S. ½ W. 73 m. from Gay Head	65	July 16	6 ♂ : 6 ♀
	922	S. ½ W. 77 m. from Gay Head	69	July 16	1 ♀ : eggs.
	940	S. by E. ½ E. 97 m. from Gay Head	130	Aug. 4	1 ♀ : eggs.
	944	SSW. 82 m. from Gay Head	124	Aug. 9	1 ♂ : 1 ♀
	949	S. 79½ m. from Gay Head	100	Aug. 23	1 : eggs.
	950	S. 75 m. from Gay Head	69	Aug. 23	1 ♂ : 2 ♀
	1026	SSW. ¼ W. 93½ m. from Gay Head	182	Sept. 8	1 ♂
	1027	SSE. ¾ E. 105½ m. from Gay Head	93	Sept. 14	1 ♂
	1038	North latitude 39° 59′, west longitude 70° 06′	146	Sept. 21	5 ♂ : 3 ♀
	1043	Off Delaware Bay	130	Oct. 10	1 ♂

Order II.—Octopoda Leach.

Cephalopoda octopoda Leach, Zool. Miscel., iii, 1817 (t. Gray).

Férussac, Tab. Syst., p. 18, 1821.

D'Orbigny, Tab. Méthod., p. 45, 1825; D'Orbig., Céphal. Acétab., p. 1.

Octocera Blainv., Dict. Sci. Nat., xxxii, 1824.

Octopia Gray, Cat. Moll. Brit. Mus., i, p. 3, 1849.

Arms eight, similar, all furnished with suckers in one or two rows; often more or less united by a web; natatory crests wanting. Suckers sessile, not oblique, destitute of horny rings or hoops. No tentacular arms. Head often larger than the body. Body short and thick, obtuse

posteriorly, usually destitute of fins. Fins, when present, small, lateral, supported by an internal transverse cartilage. Mantle extensively united to the head by a dorsal commissure. Siphon without an internal valve, united directly to the head. No olfactory crests. Eyes united to the internal lining of the sockets so as to be immovable; usually furnished with lids. No outer buccal membrane. Aquiferous pores and cavities usually absent; cephalic pores sometimes present. Internal longitudinal shell or pen absent. An external shell is present only in the genus Argonauta. In this case it is formed as a secretion from the inner surface of the expanded distal portion of the two dorsal arms of the female only, and serves mainly as a receptacle for the eggs. One of the arms of the third pair, commonly the right, is hectocotylized in the male. Sometimes the entire arm is modified and sometimes the tip only.

Family PHILONEXIDÆ D'Orbigny.

Philonexidæ (*pars*) D'Orbig., Moll. Viv. et Fos., i, 199, 1845 (t. Gray).
Gray, Catal. Moll. Brit. Mus., i, p. 24, 1849.

Body stout, oval, destitute of lateral fins. Branchial opening large. Edge of mantle united to the base of the siphon laterally by a complicated, prominent cartilage or button, fitting in a corresponding pit on the inner surface of the mantle. Dorsal commissure narrow. Head with aquiferous pores communicating with large aquiferous cavities. Arms simple, more or less united by webs. Suckers prominent.

In the male, the hectocotylized arm is developed in a sac, the entire arm being modified, and usually, when perfected, it becomes detached from the body. Probably this arm is lost and regenerated each year.

PARASIRA Steenstrup.

Parasira Steenstrup, Vidensk. Meddel. naturh. Forening, Kjöbenhavn, 1860, p. 333.
Kefferstein, in Bronn, Thier-Reich, iii, p. 1449, 1866.
Tryon, Man. Conch., i, p. 104. Verrill, Trans. Conn. Acad., v, p. 361.

Body short, thick, pouch-like, usually ornamented with raised ridges. Mantle united directly to the head dorsally; connected laterally to the base of the siphon by a deep pit and a raised, cartilaginous tubercle on each side, which fits a corresponding cartilaginous tubercle and pit, near the base of the siphon (something as a button fits into a button-hole), so that it can be separated only by using considerable force. Arms long, slender; web rudimentary. Suckers prominent, in two alternating rows. Gill-opening wide. Siphon large, intimately united to the head except at its free extremity, which is situated far forward, between the ventral arms. A large aquiferous pore, each side of the siphon, at the bases of the ventral arms.

Sexes are widely different. The hectocotylized, third right arm of the male is developed in a pedunculated sac.

Parasira catenulata Steenstrup.

Octopus tuberculatus Risso(?), Hist. nat. de l'Eur. mérid., iv, p. 3, 1826 (t. d'Orbig.).
Octopus catenulatus Férussac, Poulpes, pl. 6, bis, ter., 1828 (t. D'Orbig.).
Philonexis tuberculatus Fér. and D'Orbig., Céph. Acétab., p. 87, pl. 6, bis, ter.
Parasira catenulata Steenstrup, Vidensk. Meddel. naturh. Forening, Kjöbenhavn, 1860, p. 333.
Verrill, Amer. Journ. Sci., xix, p. 293, Apr., 1880; Trans. Conn. Acad., v, p. 362, pl. 33, figs. 2, 2*a*, 1881.

Plate XL, figures 2, 2*a*.

Female: Body relatively large, swollen, rather higher than broad, dilated below, larger in front, obtusely rounded posteriorly; upper surface smooth or finely wrinkled; lower surface covered with prominent, rounded verrucæ, or small hard tubercles, which are connected together by raised ridges, five (sometimes six) of which usually run to each tubercle, thus circumscribing angular depressed areas, each of which usually has a dark-colored spot in the center; on the sides these tubercles are less prominent and less regular, gradually fading out above. The head is decidedly smaller than the body, and smooth both above and below. The eyes are prominent, but the external opening is small, round, with simple border. The gill-opening is large, and extends upward on the sides of the neck to the level of the upper side of the eyeballs. The siphon-tube is completely united by its basal portion to the lower side of the head; its free portion is large and elongated, starting from well forward, between the bases of the ventral arms. There is a conspicuous aquiferous pore, at each side of the base of the siphon, just back of the ventral arms. The arms are stout, not very long; the inner surface is broad, with two rows of rather widely separated suckers, which run along the margins of the arms; the suckers are rather large, and considerably raised, on stout bases; the first suckers form a regular circle around the mouth; two or three basal suckers are nearly in a single row. The suckers are cup-shaped, with a deep central pit, around which there are strong radial ridges; toward the base of the arms the soft, swollen rims of the suckers are wrinkled and lobulated; farther out they are smooth and even. The beak is black, with sharp tips. It is surrounded by a thick, wrinkled buccal membrane.

The arms are slightly united at base by a narrow web, which also runs along each of the outer angles of the six upper arms, forming more or less wide marginal membranes, according to the state of contraction, and by their contractions causing the arms to curl in various directions; one of these membranes frequently disappears, the other being so stretched as to become wide, when the arm is strongly recurved; on the ventral arms the upper membrane becomes strongly developed, while the lower one is abortive. There is also a slight marginal membrane along the inner margins, running between the suckers and connecting them together. The dorsal and ventral arms are considerably larger and longer than the two lateral pairs, the dorsal ones are the stoutest. The two lateral pairs are about equal in size and length. On the dorsal arms there are about 96 suckers; on the lateral ones about 80 that can

be counted with the naked eye. The tips are very slender and covered with very minute suckers.

Color of body and head above, and of upper arms, deep brownish purple; lower surfaces of body and head with siphon and ventral arms, pale yellowish.

A fine specimen of this interesting species was taken in Vineyard Sound, Mass., by Mr. V. N. Edwards, in 1876. It was not known previously from the American coast, and has been regarded as peculiar to the Mediterranean and West Indies. The total length of this specimen is 203 millimeters; of mantle, 51 millimeters; circumference of body, 152 millimeters; length of dorsal arms, from eye, 137 millimeters; second pair, 94 millimeters; of third pair, 84 millimeters; of fourth pair, 134.5 millimeters.

The remarkable tubercles of the ventral surface mostly have five ridges converging to each, rarely six. In all other respects it agrees with the figures of Férussac and D'Orbigny. According to Targioni-Tozzetti, *P. catenulata* is distinct from *P. tuberculata*. If so, our species should bear the former name. Steenstrup considers *Octopus carena* Ver., the male.

Family ALLOPOSIDÆ Verrill.

Trans. Conn. Acad., v, p. 365, 1881.

Body thick, obtusely rounded; arms extensively webbed; mantle united directly to the head, not only by a large dorsal commissure, but also by a median-ventral and two lateral longitudinal commissures, which run from its inner surface to the basal parts of the siphon. The male hectocotylized right arm of the third pair is developed in a cavity in front of the right eye, and when mature, protrudes from an opening on the inner surface of the web, between the second and fourth pairs of arms, and finally becomes detached. It is furnished with two rows of large suckers, and with a fringe along the sides. The mode of attachment of the mantle to the head is similar to that of *Desmoteuthis*, among the ten-armed cephalopods.

ALLOPOSUS Verrill.

Alloposus Verrill, Amer. Journ. Sci., xx, p. 393, Nov., 1880; Proc. Nat. Mus., iii, p. 362, Dec., 1880; Bulletin Mus. Comp. Zool., viii, p. 112, March, 1881; Trans. Conn. Acad., v, p. 365.

Allied in some respects to *Philonexis* and *Tremoctopus*. Body thick and soft, smooth; arms (in the male only seven) united by a web extending nearly to the ends. Suckers sessile, simple, in two rows; mantle united firmly to the head by a dorsal, ventral, and two lateral muscular commissures, the former placed in the median line, at the base of the siphon; free end of the siphon short, well forward.

In the male, the hectocotylized right arm of the third pair is developed in a sac in front of the right eye (Plate XXXIX, figs. 1, 1*a*); as found in the sac, it is curled up, and has two rows of suckers; the

groove along its edge is fringed; near the end, the groove connects with a rounded, obliquely placed, broad, flat or slightly concave lateral lobe, with transverse wrinkles or plications on the inner surface; the terminal portion of the arm is a long-fusiform, smooth process.

The permanent attachment of the mantle to the siphon, by means of commissures, is a very distinctive character.

Alloposus mollis Verrill.—Webbed devil-fish.

Alloposus mollis Verrill, Amer. Journ. Sci., xx, p. 394, Nov., 1880; Proc. Nat. Mus., iii, p. 363, 1880; Trans. Conn. Acad., v, p. 366, pl. 50, figs. 1, 1*a*, 2, 2*a*; pl. 51, figs. 3, 4; Bulletin Mus. Comp. Zool., viii, p. 113, pl. 4, figs. 3, 4; pl. 8, figs. 1–2*a*, March, 1881.

Octopus?, sp., Verrill, Bulletin Mus. Comp. Zool., p. 109, pl. 4, fig. 3, 1881.

Plate XXXIX, figs. 1, 1*a*, 2, 2*a*. Plate XLII, fig. 7. Plate XLIV, fig. 1.

Body stout, ovate, very soft and flabby. Head large, as broad as the body; eyes large, their openings small. Arms rather stout, not very long, webbed nearly to the ends, the dorsal much longer than the ventral arms; suckers large, simple, in two alternating rows. Color deep purplish brown, with a more or less distinctly spotted appearance. Total length of a medium-sized specimen, 160^{mm}; of body, to base of arms, 90^{mm}; of mantle, beneath, 50^{mm}; of dorsal arms, 70^{mm}; breadth of body, 70^{mm}. Other specimens are very much larger.

This season two very large females, nearly equal in size, were taken: one at station 937, in 506 fathoms; the other at 994, in 368 fathoms. The former weighed over 20 pounds. Length, while fresh, posterior end of body to tip of 1st pair of arms, 787^{mm} (31 inches); of 2d pair, 812^{mm} (32 inches); of 3d pair, 711^{mm} (28 inches); of 4th pair, 711^{mm} (28 inches); length of mantle, beneath, 178^{mm} (7 inches); beak to end of 4th pair of arms, 559^{mm} (22 inches); breadth of body, 216^{mm} (8.5 inches); breadth of head, 280^{mm} (11 inches); diameter of eye, 64^{mm} (2.5 inches); of largest suckers, 10^{mm} (.38 of an inch). The body was remarkably soft and gelatinous in appearance, and to the touch, while living. In fact it did not have sufficient firmness to retain its natural shape when out of water, and when placed in a large pan it accommodated itself to the shape of the vessel, like a mass of stiff jelly. Color, in life, pale bluish white specked with rusty orange-brown chromatophores; inner surface of arms dark purplish brown, suckers white.

One mature, detached, hectocotylized arm (Plate XLIV, fig. 1) was taken November 16. This has two rows of large, six- or seven-lobed suckers, a very long fringe, composed of thin, flat, lacerate processes, along each side; the terminal process is fusiform, acute, and loosely covered with a thin, translucent membrane, beneath which the inner surface, bearing chromatophores, can be seen. Length of this arm, 200^{mm}; its breadth, 20^{mm}; length of terminal process, 30^{mm}; its diameter, 7^{mm}; diameter of largest suckers, 6^{mm}; length of fringe, 15^{mm}.

Two detached and somewhat mutilated arms, with portions of a third arm and of the basal web, of a large Octopod, probably of this species,

were taken by Mr. Agassiz in 1880, at station 336, north latitude, 38° 21′ 50″, west longitude, 73° 32′, in 197 fathoms. (Plate XLII, fig. 7.)

The largest of these arms is 420mm long and 36mm broad. The suckers are large, prominent, subglobular, with a contracted aperture, and have a thin membrane around the outer margin. They form two alternating, rather distant rows, except near the base, where several that are somewhat smaller than those farther out stand nearly in one row, with wide spaces between them. Diameter of largest suckers, 9 to 11mm; distance between their centers, 20 to 35mm. Color, dark purple.

Taken by the "Fish Hawk," at stations 880, 892, 893, 895, about 100 to 115 miles south of Newport, R. I., in 225 to 487 fathoms, Sept. and Oct., 1880; off the mouth of Chesapeake Bay, at station 898, November 16, 1880, in 300 fathoms, by Lieut. Z. L. Tanner; and off Martha's Vineyard, 310-715 fathoms, 1881.

Alloposus mollis.—Specimens examined.

Station.	Locality.	Fath.	When received.	Received from.	Specimens.
	Off Newport, R. I.				
	N. lat. W. long.				
880	39° 48′ 30″ 70° 50′ 00″	252	Sept. 13, 1880	U. S. Fish Com.	2 ♂ : 1 ♀
881	Farther southward	325	Sept. 13, 1880	do	1
892	39° 46′ 00″ 71° 05′ 00″	487	Oct. 2, 1880	do	1
893	39° 52′ 20″ 70° 58′ 00″	372	Oct. 2, 1880	do	2
895	39° 56′ 30″ 70° 59′ 45″	238	Oct. 2, 1880	do	1
	Off Chesapeake Bay.				
898	37° 24′ 00″ 74° 17′ 00″	300	Nov. 16, 1880	do	4
	Off Delaware Bay.				
336	38° 21′ 50″ 73° 32′	197	——, 1880	"Blake" expedition	1 l. frag.
	Off Martha's Vineyard.				
937	S. by E. ½ E. 102 m. from Gay Head	506	Aug. 4, 1881	U. S. Fish Com.	1 l. ♀
938	S. by E. ½ E. 100 m. from Gay Head.	310	Aug. 4, 1881	do	1 j.
952	S. ¼ E. 87½ m. from Gay Head	388	Aug. 23, 1881	do	1 j.
953	S. ½ E. 91½ m. from Gay Head	715	Aug. 23, 1881	do	1 j. ♀
994	SSW. ¼ W. 104½ m. from Gay Head.	368	Sept. 8, 1881	do	1 l. ♀

FAMILY ARGONAUTIDÆ Cantr.

Cantraine, Mall. Médit., p. 13, 1841; H. & A. Adams, Genera, vol. i, p. 23.

Argonauta argo Linné.

Shells of this species, some of them entire, were taken by the "Fish Hawk" at several of the stations 70 to 115 miles south of Martha's Vineyard and Newport, R. I., in 64 to 365 fathoms. At least nine specimens were dredged. At station 894, in 365 fathoms, two entire and nearly fresh shells were taken, and another nearly complete. They belong to the common Mediterranean variety. Fragments were also taken at stations 865–7, 871, 873, 876, 892, 895.

The capture of a living specimen, probably of this species, on the coast of New Jersey, has been recorded by Rev. Samuel Lockwood, in Amer. Naturalist, xi, p. 243, 1877.

Family OCTOPODIDÆ D'Orbigny.

Octopodidæ (*pars*) D'Orbigny, Moll. Viv. et Fos., i, pp. 159, 164, 1845 (t. Gray); (*pars*) Céphal. Acétab., p. 3.
Octopidæ Gray, Catal. Moll. Brit. Mus., i, p. 4, 1849.

Head very large; external ears, small, simple openings, behind the eyes. Body short, thick, rounded posteriorly, destitute of lateral fins and internal cartilages. Mantle united to the head by a broad dorsal commissure. No complex connective cartilages, nor commissures, uniting the mantle and base of siphon. Opening to gill-cavity narrow.

Siphon large. Arms with either one or two rows of suckers, and with a more or less developed basal web. Eyes furnished with an internal translucent lid and also capable of being covered by the external integument. Sexes similar externally, except that in the male the right arm of the third pair is hectocotylized by the formation of a spoon-shaped organ at the tip.

ELEDONE Leach.

Octopus (*pars*) Lamarck; Cuvier; Blainville, etc.
Eledone Leach, Zool. Misc., iii, 137, 1817 (t. Gray); D'Orbig., Céphal. Acétab., p. 72 (subgenus); Gray, Catal. Moll. Brit. Mus., i, p. 21, 1849.

Body, mantle, and siphon as in *Octopus*. Suckers in a single row on all the arms. In the male the right arm of the third pair is hectocotylized by the formation of a small spoon-shaped tip and a lateral groove, nearly as in some species of *Octopus*.

Eledone verrucosa Verrill.

Bulletin Mus. Comp. Zool., viii, p. 105, plates 5, 6, March, 1881; Trans. Conn. Acad., v, p. 380, pl. 52, 53, 1881.

Plate XLIV, figs. 3, 3*a*.

A stout species, covered above with prominent, rough, wart-like tubercles, and with a circle of the same around the eyes; four or five of those above the eyes are larger and more prominent. Body thick, broad-ovate, swollen beneath, moderately convex above, obtusely rounded posteriorly.

Male: Head as broad as the body, whole upper surface of body and head to base of arms covered with prominent and persistent, unequal warts, which are roughened by sharp conical papillæ, eight or ten on the larger warts, but only two or three on the smaller ones; the warts diminish in size anteriorly, and on the sides, before they disappear; around the eyes they form irregular circles; just above each of the eyes there are two much larger ones, bearing more than twenty conical papillæ; there is one before and one behind these, of somewhat smaller size. Eyes large, the lower lid purple and thickened, overlapping the upper one, which is thin and whitish.

Arms considerably longer than the head and body, not very stout, compressed, bearing a single crowded row of large whitish suckers,

which are mostly separated by spaces less than half their diameter; margins of suckers soft and much thickened. The three lower pairs of arms are very nearly equal in length and size; the dorsal ones are a little shorter and smaller. A thin web unites all the arms for about one-fourth of their length, and runs up along their sides for about half their length. The male has the third right arm (Plate XLIV, fig. 3, 3*a*) hectocotylized at the tip; the modified tip is preceded by 45 suckers, and is bordered ventrally by a broad membrane, having a white groove along its inner surface; the terminal organ (fig. 3*a*) consists of a small, ovate-triangular, fleshy disk, with its inner surface slightly concave and finely wrinkled transversely, and terminating proximally in a small point.

Color dark purplish brown, darker purple beneath. Chromatophores small and densely crowded.

The female is considerably larger than the male, and has the warts over the back and around the eyes relatively smaller, but of the same character. The arms appear to be larger than those of the male, but this is probably due to the fact that the male has become more contracted by the stronger alcohol in which it was placed.

This female specimen illustrates well the uselessness of the attempts to divide the species of *Octopus* and allied genera into groups or sections according to the relative lengths of the arms, as J. E. Gray and others have done, for in this and many other cases the proportions of the arms of the right side would throw it into one section; those of the left side into another. The male would have to be put into a third section.

The two known examples of this species were both taken by Mr. A. Agassiz, while dredging on the United States Coast Survey steamer "Blake," in 1880.

Measurements in millimeters.

	No. 12. Male.	No. 13. Female.	
		Right side.	Left side.
Total length	202	360	.....
End of body to center of eye	58	100	.....
Breadth of body	55	65	.....
Breadth across eyes	49	.....	.....
Length of dorsal arms, from mouth	135	255	260
Length of second pair of arms	155	260	235
Length of third pair of arms	.....	225	240
Length of hectocotylized arm	130	.....	.....
Length of modified tip	4.5	.....	.....
Length of ventral arms	145	210	225
Greatest breadth of lateral arms	12	18	18
Diameter of largest suckers	3	5	5

Specimens examined.

No.	Stat.	Locality.	Fath.	When received.	Specimens.	
					No.	Sex.
12	305	N. lat. 41° 33′ 15″; W. long. 65° 51′ 25″	810	1880	1	♂
13	312	N. lat. 39° 50′ 45″; W. long. 70° 11′	466	1880	1	♀

OCTOPUS Lamarck, 1799.

Octopus (*pars*) Lamarck, Syst. des Anim. sans Vert., p. 60, 1801. Cuvier, Rég. Anim., ii, 1817. D'Orbigny, Céphal. Acétab., p. 3. Gray, Catal. Moll. Brit. Mus., i, p. 4, 1849. Verrill, Trans. Conn. Acad., v, p. 367, 1881.

Body short, thick, more or less rounded, usually flattened, often tubercular or warty, but sometimes smooth, usually with one or more tubercles or cirri situated above the eye. Mantle directly united to the head, dorsally, by a broad commissure, extending below the eyes to the base of the siphon. Base of the siphon without any complicated, connective cartilages. Arms united by a more or less extensive basal web. Suckers sessile, in two alternating rows. Siphon not intimately united to the whole length of the head, the free terminal portion situated behind or beneath the eyes. No aquiferous pores nor brachial pouches.

The sexes are similar in form. In the male the right arm of the third pair is hectocotylized, its terminal portion being changed into a spoon-shaped organ, smooth on the outer, convex side and furnished with a series of transverse ridges on the inner concave side, and with a basal angular lobe, from which a groove or furrow extends along the lower margin of the arm to the basal web. In some species of *Octopus* the modified tip is very small, but in others, very large.

The female has the oviducts symmetrically developed on both sides. The egg-sacs are large, pyriform, not very numerous, attached by the small end.

Octopus Bairdii Verrill.—Baird's devil-fish.

Octopus Bairdii Verrill, Amer. Journ. Sci., v, p. 5, Jan., 1873; xix, p. 294, 1880; American Naturalist, vii, p. 394, figs. 76, 77, 1873; Am. Assoc. Adv. Sci. for 1873, p. 348, pl. 1, figs. 1, 2, 1874.

G. O. Sars, Mollusca Regionis Arcticæ Norvegiæ, p. 339, pl. 33, figs. 1–10 (♀), pl. xvii, figs. 8*a* to 8*d* (dentition and jaws), 1878.

Tryon, Man. Conch., i, p. 116, pl. 32, figs. 37, 38 (description and figures from the papers by A. E. V.).

Verrill, Trans. Conn. Acad., v, p. 368, pl. 33, figs. 1, 1*a*; pl. 34, figs. 5, 6; pl. 36, fig. 10; pl. 38, fig. 8; pl. 49, figs. 4, 4*a*; pl. 51, figs. 1, 1*a*; Bulletin Mus. Comp. Zool., viii, p. 107, pl. 2, figs. 4, 4*a*; pl. 4, figs. 1, 1*a*, 1881.

Plate XLI, figures 1, 2, 3, 3*a*. Plate XLII, figures 1–5.

The body is short, thick, somewhat depressed, broadly rounded posteriorly, separated from the head only by a slight constriction at the sides. Head almost as broad as the body, swollen above and around the eyes, concave in the middle above; around the eyes, and especially in front and above, there are numerous small, conical, often irregular and rough tubercles; a little removed from the upper side of each eye is a much larger, rough, irregularly conical, erectile cirrus, which has some small, more or less prominent, conical papillæ on its surface; the whole upper surface of the body, head, and arms is also covered with minute scattered papillæ, which are usually but little prominent, but in some of the larger males they become much larger and more numerous, and have the form of small prominent warts.

The jaws (Plate XLII, fig. 3) have rather blunt, slightly incurved tips, with the angle at the bases of the cutting edges round and without any distinct notch. The odontophore (Plate XLII, fig. 4) has a median row of large, acute teeth with broad bases, without lateral denticles; the inner lateral teeth are much smaller, with curved, acute-triangular points; outer lateral teeth longer and more acute; marginal plates large and distinct.

Siphon large, tapering, capable of being bent in all directions, so as to be used for swimming either forward, backward, or sideways, according to its direction.

Arms subequal, relatively short, stout, tapering to slender points, connected for about one-third of their length by a web, which extends as a narrow membrane along their margins to near the ends. Suckers small, not crowded, alternating pretty regularly in the two rows; in the original type-specimen, which was not full-grown, the arms of the first pair each had about sixty-five suckers; those of the fourth pair about sixty. In a larger example (♀) the dorsal arms have about 94 suckers; the third pair about 100; the ventral ones about 90.

In the male, the right arm of the third pair has its terminal portion, for about a third of its entire length, modified for reproductive purposes into a large spoon-shaped organ (Plate XLI, fig. 1*a*), broadly elliptical in outline, with the sides incurved, and the end somewhat trilobed; interior deeply concave, with ten to twelve, and occasionally, in the largest examples, thirteen elevated transverse folds; at the base, there is a fold bent into an acute angle, the apex directed forward, leaving a deep V-shaped sinus behind it, which is a continuation of a shallow groove, formed by a thickening of the web along the lower side of the arm, and terminating midway between it and the fourth arm. At the end, the arm terminates in a small conical tip, between the two broadly rounded lobes of the spoon-shaped organ; at the base of this organ there is a slight constriction; the basal portion of the arm bears 30 to 37 suckers, like those on the other arms. The modified portion of the arm is considerably longer than the distance between the constriction at its base and the interbrachial web, and about equal to one-half the total length of the part which bears suckers. The corresponding arm on the left side is of the ordinary form, and has, in medium-sized examples, about 51 suckers.

The female differs but little from the male, externally, except in lacking the modification of the third right arm.

Some of the larger females were filled with mature eggs. These are large and rather numerous, occupying a large part of the interior of the body. They are enclosed in long-pyriform sacs, with the small end tapering to a filiform point, by which they adhere.

Length of the original male specimen, in alcohol, exclusive of the arms, 44^{mm}; breadth of the body, 31^{mm}; between eyes, 18^{mm}; length of arm, of the first pair, from mouth, 57^{mm}; from mouth to edge of web,

18mm; length of modified portion of third right arm, 18mm; breadth of this organ, when expanded, 11.5mm. Subsequently, considerably larger specimens, both male and female, have been taken.

One of the largest males (station 878) measures, from tip of dorsal arms to end of body, 163mm; from edge of dorsal web to end of body, 75mm; from edge of mantle beneath, to end of body, 38mm; breadth of body, 48mm; of head, 41mm; length of dorsal arms, to beak, 110mm; of second pair, 112mm: of third pair, 115mm; of fourth pair, 110mm; of hectocotylized arm, 85mm; length of terminal spoon, 33mm; its breadth, 17mm. This specimen has 13 transverse lamellæ in the spoon.

One of the largest females (station 895) taken in the breeding season and filled with eggs, in alcohol, measures, from tip of dorsal arms to end of body, 170mm; edge of dorsal web to end of body, 90mm; mantle, beneath, 46mm; breadth of body, 55mm; of head, 41mm; length of dorsal arms, from beak, 125mm; of second pair, 120mm; of third pair, 115mm; of fourth pair, 115mm.

When living, the ground-color was usually pale, translucent, bluish white above, thickly speeked with light orange-brown and dark purplish brown. Its colors were changeable, but apparently less actively so than in the squids.

This species was first discovered by the writer while dredging, in 1872, on the United States Steamer "Mosswood", in the Bay of Fundy, off Eastport, Me., in 75 to 80 fathoms. Although so recently discovered, it proves to have a very extensive range, both geographically and in depth. It is one of the most common and characteristic inhabitants of the bottom, in 100 to 500 fathoms, along our entire coast, from South Carolina to Newfoundland. It was taken in the trawl, by the U. S. Fish Commission, in 1872, 1873, 1874, 1877, 1878, 1879, 1880, and 1881, in depths ranging from 50 to 500 fathoms, at numerous localities, from off Halifax, N. S., and the Bay of Fundy, to the region 90 to 100 miles south of Martha's Vineyard and Newport, R. I., where it is common and of large size. It was obtained by Mr. A. Agassiz, on the "Blake", in 1880, at various stations, from N. lat. 41° 34′ 30″, to 32° 43′ 25″, in 178 to 524 fathoms.

In November, 1880, it was taken by Lieut. Z. L. Tanner, on the "Fish Hawk", off the mouth of Chesapeake Bay, in 157 to 300 fathoms.

The Gloucester fishermen have brought in several specimens from the banks off Nova Scotia and Newfoundland. These were presented by Captain Murphey and crew, of the schooner "Alice M. Williams" (lots 372, 501, 917); by Capt. J. W. Collins and crew, of the "Marion" (lot 264); by Capt. J. F. Critchett and crew, of the "Commonwealth" (lot 421); by Mr. E. Perkins, of the "Grace L. Fears" (lot 351); by Mr. Robert Hurlburt, of the "Barracouta" (lot 605); by Capt. Thomas Olsen and crew, of the "Epes Tarr" (lot 771); and by Capt. J. McDonald and crew, of the "G. P. Whitman" (lot 792).

Prof. G. O. Sars has taken it, off the Norwegian coast, in 60 to 300 fathoms.

It occurs both on soft muddy bottoms and on hard bottoms. Both sexes often occur together, but the males are usually the most numerous.

Males, with spermatophores escaping, have been taken, from July 27 to September 21, at stations 138, 161, 163, 223, &c.

One of the specimens obtained by Mr. Agassiz is remarkable for the length and slenderness of the cirrus above the eyes (Plate XLI, fig. 3). This is an immature male, and does not appear to differ in any other way from ordinary specimens, of similar size. The appendage of the hectocotylized arm is small and not fully developed (as is always the case in young males), and has an ovate-triangular form, a slightly concave surface, and only a few transverse lamellæ.

This species resembles *O. lentus*, but has a much larger and rough or lacerate cirrus above the eye. The modified arm of the male is also different.

It is somewhat related to *O. Grœnlandicus* Dewh., but the male of the latter has the third right arm much longer, with the modified spoon-shaped portion relatively very much smaller and quite different in form, and with more numerous folds, and the basal part bears 41 to 43 suckers; the other arms also have more numerous suckers; the web is less extensive and the body is more elongated, and appears to be smooth, and destitute of the large cirri above the eyes.

O. obesus has the spoon-shaped part of the third right arm relatively larger, and several of the basal suckers of the other arms in a single row. It also differs in other respects.

Specimens of this species were kept alive for several days, in order to observe its habits. Several characteristic drawings, some of which are here reproduced (Plate XLI, fig. 2; Pl. XLII, figs. 1, 2), were made from life by Mr. J. H. Emerton, showing its different attitudes.

When at rest it remained at the bottom of the vessel, adhering firmly by some of the basal suckers of its arms, while the outer portions of the arms were curled back in various positions; the body was held in a nearly horizontal position, and the eyes were usually half-closed and had a sleepy look; the siphon was usually turned to one side, and was long enough to be seen in a view from above.

When disturbed, or in any way excited, the eyes opened more widely, especially at night; the body became more contracted and rounded, and was held more erect; the small tubercles over its surface and the larger ones above the eyes were erected, giving it a very decided appearance of excitement and watchfulness.

It was rarely, if ever, observed actually to creep about by means of its arms and suckers, but it would swim readily and actively, circling around the pans or jars, in which it was kept, many times before resting again.

In swimming backward the partial web connecting the arms together

was used as an organ of locomotion, as well as the siphon; the web and the arms were alternately spread and closed, the closing being done energetically and coincidently with the ejection of the water from the siphon, and the arms, after each contraction, were all held pointing straight forward in a compact bundle, so as to afford the least resistance to the motion (Plate XLI, fig. 2). As the motion resulting from each impulse began to diminish sensibly, the arms were again spread and the same actions repeated. This action of the arms and web recalled that of the disk of the jelly-fishes, but it was much more energetic.

The siphon was bent in different directions to alter the direction of the motions, and by bending it to the right or left side, backward motions in oblique or circular directions were given, but it was often bent directly downward and curved backward, so that the jet of water from it served to propel the animal directly forward. This, so far as observed, was its only mode of moving forward. The same mode of swimming forward has previously been observed in cuttle-fishes (*Sepia*) and in squids (*Loligo*).

This species was much more active and animated in the night than during the day. It is probably largely nocturnal in its habits, when at liberty. None of the specimens could be induced to take food, and none survived more than four or five days, although the water was frequently renewed to keep it cool and pure. They had been rather roughly handled by the dredges and trawls, without doubt; but the unavoidable exposure to the higher temperature of the water, near and at the surface, especially in summer, is sufficient to kill many of the deep-water animals, while others that live for a short time never entirely recover from the injury thus received.

Octopus Bairdii.—Specimens examined.

No.	Locality.	Fathoms.	Bottom.	When collected.	Specimens.
	United States Fish Commission.				*Number and sex.*
	Bay of Fundy	75		1872	1 ♂ : 1 j. ♂ : 1 j. ♀
	....do	80		1872	1 l. ♂
	....do	60		1872	1 ♂
	Off Grand Menan Island	97–110	Gravel	1872	1 j. ♂
	Casco Bay	64		1873	1 med.
				1877	
32	Gulf of Maine	90	Mud	Aug. 14	1 l. ♂ (fig'd).
32	....do	90	....do	Aug. 14	2 l. ♂ : 2 m. ♂
45	Off Cape Sable	91	Fine sand	Aug. 21	1 l. ♂ : 4 j. ♂ : 4 j. ♀
85–86	Off Halifax	101	....do	Sept. 6	4 ♂ : 4 ♀
	Gulf of Maine and Massachusetts Bay.				
				1878.	
130	Off Gloucester, Mass	49	Mud	July 23	1 ♂
138	Off Cape Ann	59	Muddy	July 29	1 j. ♂ : 2 l. ♂ : 2 ♀
156	....do	42	Mud	Aug. 15	1 j.
161	....do	54	Sand	Aug. 16	1 l. ♂ : 1 j. ♂ : 1 j. ♀
163	....do	73	Fine sand	Aug. 16	5 j. ♂ : 3 l. ♂ : 1 j. ♀
164	....do	75	....do	Aug. 16	2 ♂ : 3 j. ♂ : 2 l. ♀ : 3 j. ♀
182	South of Cape Ann			Aug. 29	4 j. ♀
184	Off Gloucester, Mass	45	Muddy	Aug. 29	3 j. ♀ : 1 j. ♂
199	Off Cape Ann	58	Mud	Sept. 2	1 j. ♂ : 2 l. ♂ : 1 l. ♀ : 2 j. ♀
207	Off Gloucester, Mass	42	Soft mud	Sept. 16	1 j. ♂
211	Off Cape Ann	60	Mud	Sept. 17	4 j. ♂ : 2 j ♀ : 1 ♀
213	....do	68	....do	Sept. 17	1 l. ♂

Octopus Bairdii—Continued.

No.	Locality.	Fathoms.	Bottom.	When collected.	Specimens.
	Gulf of Maine and Massachusetts Bay—Continued.			1878.	
214	Off Cape Ann	57	Fine sand	Sept. 17	1 m. ♀
223	do	47	Soft mud	Sept. 21	2 ♂ : 1 ♀ : 1 l. ♀
233	South of Cape Ann	45	do	Sept. 24	1 j. ♂
234	do	43	do	Sept. 24	2 j. ♂ : 1 j. ♀
238	Off Cape Ann	43	do	Sept. 26	2 ♀
				1879.	
264	Off Cape Cod	80	Mud	Jnly 29	2 j. ♂ : 1 j. ♀ : 1 l. ♀
342	do	94	do	Sept. 10	2 m. ♂ : 1 j. ♀
364	do	70	Hard sand	Sept. 18	3 l. ♂ : 2 j. ♂ : 2 l. ♀
372	Off Chatham, Mass	70	Sand	Sept. 19	1 l. ♀
	Off Newport, R. I.				
	N. lat. W. long.			1880.	
869	40° 02′ 18″; 70° 23′ 06″	192	Mud and sand	Sept. 4	1 l. ♀ : 3 j. ♀
870	40° 02′ 36″; 70° 22′ 58″	155	Fine sand	Sept. 4	1 l. ♂ : 3 j.
874	40° 00′ 00″; 70° 57′ 00″	85	Mud	Sept. 13	1
878	39° 55′ 00″; 70° 54′ 15″	142½	do	Sept. 13	1 l. ♂
879	39° 49′ 30″; 70° 54′ 00″	225	Fine sand	Sept. 13	1 ♂ : 1 ♀
880	39° 48′ 30″; 70° 54′ 00″	252½	Mud	Sept. 13	1 ♂ : 1 ♀
892	39° 46′ 00″; 71° 05′ 00″	487	do	Oct. 2	1 l. ♀
893	39° 52′ 20″; 70° 58′ 00″	372	do	Oct. 2	2 ♂ : 2 ♀
894	39° 53′ 00″; 70° 58′ 30″	365	Sand	Oct. 2	3 l. ♂ : 3 ♀
895	39° 56′ 30″; 70° 59′ 45″	238	Mud	Oct. 2	2 l. ♂ : 2 l. ♀
	Off Chesapeake Bay.				
	N. lat. W. long.				
897	37° 25′ 00″; 74° 18′ 00″	157½	Sand	Nov. 16	1 l. ♂
898	37° 24′ 00″; 74° 17′ 00″	300	Mud	Nov. 16	2 ♂ : 4 ♀
	Blake Expedition, United States Coast Survey.				
	N. lat. W. long.				
303	41° 34′ 30″; 65° 54′ 30″	306		1880	1 ♂ (fig'd).
332	35° 45′ 30″; 74° 00′ 48″	263		1880	4 ♂ : 1 ♀ j.
327	34° 00′ 30″; 76° 10′ 30″	178		1880	1 ♂ : 1 ♀
310	39° 59′ 16″; 70° 18′ 30″	260		1880	1 ♂
336	38° 21′ 50″; 73° 00′ 32″	197		1880	1 ♂ j.
321	32° 43′ 25″; 77° 20′ 30″	233		1880	1 ♂ : 1 ♀ j.
306	41° 32′ 50″; 65° 55′ 00″	524		1880	1 ♂ j.
	Off Martha's Vineyard, United States Fish Commission.				
				1881.	
925	S. ¼ W. 86 miles from Gay Head	224	Sand and mud	July 16	1 l. ♂ : 3 j. ♂
939	S. by E. ½ E. 98 miles from Gay Head	258	Sand and mud	Ang. 4	1 ♂ : 1 ♀ : 1 j.
945	S. by W. ¾ W. 84½ miles from Gay Head	202	Sand and mud	Ang. 9	3 ♀ : 1 ♂
946	S. by W. ¾ W. 87½ miles from Gay Head	241	Sand and mud	Ang. 9	4 ♀ : 5 ♂ : 2 j.
947	S. by W. ¾ W. 89 miles from Gay Head	312	Sand and mud	Aug. 9	1 l. ♀ : 4 ♂
951	S. 85 miles from Gay Head	219	Mud	Ang. 23	4 ♀ : 2 ♂
952	S. ¼ E. 87½ miles from Gay Head	388	Sand and mud	Aug. 23	4 ♀ : 2 ♂
994	SSW. ¼ W. 104½ miles from Gay Head	368	Mud	Sept. 8	1 l. ♂
997	SSW. ¼ W. 103½ miles from Gay Head	335	Mud	Sept. 8	1 j. ♂
998	SSW. ¼ W. 102½ miles from Gay Head	302	Mud	Sept. 8	1 ♂ : 1 ♀
1025	SSW. ¼ W. 95 miles from Gay Head	216	Mud	Sept. 8	4 j.
1026	SSW. ¼ W. 93½ miles from Gay Head	182	Mud	Sept. 8	1 l. ♂ : 1 l. ♀
1028	SSE. ¾ E. 108½ miles from Gay Head	410	Mud	Sept. 14	1 ♂
1033	SSE. ½ E. 106 miles from Gay Head	183	Sand & gravel	Sept. 14	1 ♂
1035	SSE. ½ E. 103½ miles from Gay Head	120	Sand	Sept. 14	1 l. ♂
1045	Off Delaware Bay	312	Mud	Oct. 10	1 l. ♂
1047	Off Delaware Bay	156	Sand	Oct. 10	1 ♀

Octopus Bairdii—Continued.

Lot.	Locality.	Fathoms.	Bottom.	When collected.	Specimens.
	Gloucester Fisheries.		VESSEL.	1879–'80.	
264	42° 49′ N. lat.; 62° 57′ W. long....	250	Marion	Jan.	1 l. ♂
351	44° 17′ 00″ N.; 58° 10′ 00″ W	120	Grace L. Fears	June 5	1 j.: 1 m. ♀
372	Off Miquelon Island.....	7	Alice M. Williams.	July —	1
421	Banquereau, off Nova Scotia.....	300	Commonwealth	Aug. 14	1 m. ♀
501	43° 14′ 00″ N.; 61° 07′ 00″ W	250	Alice M. Williams.	Oct. 9	1 m. ♀
721	Grand Bank	.....	Guy Cunningham.	July 8	1 l. ♀
605	Brown's Bank	.....	Barracouta ...	Jan. —	1 mutilated.
771	Off Saint Peter's Bank	80	Epes Tarr	July —	1 ♂: 1 ♀
792	.....	.....	G. P. Whitman	Aug. —	1 l. ♂
917	Banquereau, N. S	.....	Alice M. Williams.	.....	1 l. ♂

In the last column of this table, *l*=large; *j*=young; *m*=medium sized; ♂=male; ♀=female.

Octopus lentus Verrill.

Verrill, Amer. Journ. Sci., xix, p. 138, Feb., 1880; p. 294, April, 1880; Trans. Conn. Acad., v, p. 375, pl. 35, figs. 1, 2; pl. 51, fig. 2; Bulletin Mus. Comp. Zool., viii, p. 108, pl. 4, fig. 2, ♂.

Plate XLIII, figures 1, 2, female. Plate XLIV, figure 2, male.

Female (type-specimen): body broad, stout, depressed, slightly emarginate at the posterior end, rather soft to the touch, and in some specimens gelatinous in appearance; a thin, soft, free, marginal membrane runs along the sides and around the posterior end of the body, becoming widest (about 12^{mm}) posteriorly; in some of the more strongly contracted specimens this membrane is but little apparent. Head large, broad, depressed, with the eyes large and far apart; above each eye there is a small, simple, conical, acute, contractile cirrus. A well-developed, thin web connects the arms, considerably above their bases, and then runs up to the tips as a broad margin to each arm.

The arms are rather large, stout at base, with a broad inner face, and taper gradually to very slender tips; the first and third pairs are nearly equal in length; those of the second are also about equal in length to the fourth pair, but are somewhat shorter than the first and third. The arms on the right side are all somewhat longer than the corresponding ones on the left. The arms, measuring from the beak, are more than twice as long as the body. The suckers are arranged in two distinct rows, to the base.

Color of head and body, above, and of body, beneath, deep reddish-brown, closely specked with darker brown, and with many small roundish spots of whitish on the body and arms.

Length of the type-specimen (female) from the beak to end of body, not including marginal web, 60^{mm}; breadth of web, 22; total length, 194; breadth of body, 40; breadth of head across eyes, 32; of eye-openings, 10; of eye-balls, 17; length of mantle, beneath, 38; length of first pair

of arms, 112 and 105; of second pair, 103 and 96; of third pair, 112 and 106; of fourth pair, 94 and 97; breadth of those of the three upper pairs, 8; of the ventral pair, 7mm.

Male: Body depressed, rounded posteriorly, with only a trace of a lateral and posterior fold; surface soft and nearly smooth, but showing a small number of minute white papillæ sparsely scattered over the dorsal surface. Cirrus above the eye small and simple, usually contracted into a small wart-like papilla. Head broad and flattened; eyes large. Arms rather long and slender, with slender tapering tips, their bases united by a rather wide web. Suckers small, very prominent, forming two regular rows quite to the base.

The first two pairs of arms are nearly equal and somewhat longer than the two lower pairs, which differ but little between themselves. The hectocotylized arm (third of right side) bears thirty five suckers, in two rows, and a remarkably large, terminal spoon-shaped organ, which occupies more than a third of the total length of the arm; its sides are bent up and the edges inrolled, so as to form a deep cavity; its outer end is broadly rounded laterally, and terminates in a central, narrow, acute lobe; internally there are nine large, high, oblique lamellæ, with deep fossæ between them; the proximal end has a large, acute, triangular lobe, with involute margins; from this lobe a broad groove extends along the lower edge of the arm to the margin of the web; where it terminates there is a distinct thickening of the bounding membrane.

The two males of this species, described above, were dredged by Mr. Agassiz, on the Blake, in 1880, in 464 and 603 fathoms. They agree well in the peculiar characters and large size of the appendage of the hectocotylized arm. The females only were previously known. Although these males have a mere trace of the loose membranous fold of skin, along the sides and around the posterior end, so conspicuous in the original female specimen of this species, they agree so well in other characters that I unite them without much hesitation. It is probable that the presence or absence of the membranous fold, in this and other species, may be due merely to differences in the state of contraction when they die, or even to differences in the strength of the alcohol.

Measurements in millimeters.

	Right side. ♂	Left side. ♂	Right side. ♀	Left side. ♀
Total length	95		194	
Posterior end to center of eye	34			
Eye to tip of dorsal arms	64			
Breadth of body	28		40	
Breadth of head	22		32	
Length of dorsal arms from mouth	65	61	112	105
Length of second pair from mouth	61		103	96
Length of third pair from mouth		52	112	106
Length of hectocotylized arm from mouth	58			
Length of fourth pair		53	94	97
Length of spoon-shaped appendage	23			
Breadth of the same	16			

The first specimen of this species was taken off Nova Scotia, near Le Have Bank, in 120 fathoms, by Capt. Samuel Peeples and crew of the schooner "M. H. Perkins", and presented to the U. S. Fish Commission. A few others have since been brought in by the Gloucester fishermen from the bank fisheries. Mr. A. Agassiz dredged it on the Blake in 1880, as far south as N. lat. 33° 42′ 15″. It ranges in depth from 120 to 603 fathoms.

In the soft consistency of the flesh and skin this species resembles *Octopus obesus*. It differs in the shorter and posteriorly emarginate body, and especially in the arrangement of the suckers, which in that species are in a single series toward the bases of the arms.

Octopus lentus.—Specimens examined.

No.	Stat.	Locality.	Fath.	When coll'd.	Specimens. No. and sex.
7	326	N. lat. 33° 42′ 15″, W. long., 76° 0′ 50″ (Blake)	464	1880	1 ♂ 1 ♀
10	329	N. lat. 34° 39′ 40″, W. long., 75° 14′ 40″ (Blake)	603	1880	1 ♂ (fig'd).
553	.....	Le Have Bank, N. S. (sch. M. H. Perkins)	120	1879	1 ♀ (fig'd).
718	.....	S. of Newfoundland (sch. Proctor Brothers)	150	1880	sm. ♀
737	.....	St. Peter's Bank (sch. Augusta H. Johnson)	200	1880	1 l. ♀
807	.....	Banquereau (sch. Epes Tarr)	.....	1880	1 ♀
808	.....	N. lat. 44° 32′; Gr. Bank (sch. Guy Cunningham)	.....	1880	1 ♀

Octopus obesus Verrill.—(Stout devil-fish.)

Octopus obesus Verrill, American Journ. Sci., vol. xix, p. 137, Feb., 1880; vol. xix, p. 294, Apr., 1880; Trans. Conn. Acad., vol. v, p. 379, pl. 36, figs. 3, 4, 1881.

Plate XLII, figures 6, 6*a*.

Male: Remarkable for the great size of the spoon-shaped organ of the right arm of the third pair. Body relatively large, stout, oblong-oval, somewhat flattened above, obtusely rounded at the posterior end; soft and somewhat gelatinous in texture; skin, so far as preserved, smooth, soft. No cirrus exists above the eye, in our specimen, but the skin is not so well preserved in that region as to render it certain that a small one may not have existed, in life. Eyes very large.

Arms moderately long, the dorsal longest, others successively shorter; all are somewhat laterally compressed at base, tapering to long, slender tips; a moderately developed web connects them together at base. The hectocotylized arm (third of right side), bears at the end a very large, broad and thick, but not very deep, spoon-like organ, occupying more than a third of the total length of the arm; its inner surface is crossed by eleven oblique, thick, rounded folds or ribs, ten of them converging backward to the median line and at their outer ends joining a marginal thickening; the distal end terminates in a median pointed lobe, with a thin, rounded, lateral lobe each side of it; the proximal border is formed by the last (eleventh) fold, which is V-shaped, with the apex pointing distally. A broad, thin, marginal membrane extends along the

lower side of the arm, from the terminal organ to the base. The suckers have been partly detached from this arm.

The suckers of all the arms are moderately large, nearly globular in form, rather numerous; the first six to ten at the base are nearly in one line, except on the left arm of the sceond pair, and appear to form only a single row; in this part the inner face of the arm is narrow, most so on the right arm of the second pair, and least on the left arm of the same pair; farther out this face becomes broader and the suckers are in two distinct rows. The suckers are destroyed on the distal portion of all the arms.

The color of the body and arms is mostly destroyed, but so far as preserved, is pale pinkish, more or less thickly speckled with distinct reddish brown spots, most conspicuous at the bases of the arms and above the eyes (elsewhere the color is probably not so well preserved). Length of body, from posterior end to base of arms, 82^{mm}; to center of eye, 72; to edge of mantle, beneath, 49; to tip of right dorsal arm, 213; left, 198; to tips of second pair, 200; to tip of right arm of third pair, 173; of left, 197; to tip of right of fourth pair, 187; of left, 178: to edge of web, 110; breadth of body, in middle, 46; breadth of head, across eyes, 38; breadth of dorsal arms, at base, 8; diameter of largest suckers, 3; length of spoon-shaped end of right arm of third pair (hectocotylized), 35; breadth, 16; length of the rest of arm, to mouth, 65^{mm}.

Taken from the stomach of a halibut, 36 miles east from the N. E. light of Sable Island, in 160 to 300 fathoms, by Charles Ruckley, of the schooner H. A. Duncan, and presented by him to the U. S. Fish Commission, 1879.

A second, smaller specimen, apparently of this species, was also taken from the stomach of a halibut, from Banquereau, off Nova Scotia, in 150 fathoms, and presented to the U. S. Fish Commission by Capt. Chas. Markuson and crew, of the schooner "Notice", April, 1880. The latter specimen was, however, in too bad condition to afford any additional characters.

This species differs from *Octopus Bairdii* V. and *O. lentus* V., from the same region, in its longer and larger body, and especially in having the basal suckers in a single row. The 'spoon' of the hectocotylized arm is very much larger than in *O. Grönlandicus*, and considerably larger and flatter and more deeply trilobed at the end than in *O. Bairdii*.

Octopus piscatorum Verrill.—(Fishermen's devil-fish.)

Octopus piscatorum Verrill, Amer. Journ. Sci., vol. xviii, p. 470, Dec., 1879; vol. xix, p. 294, Apr., 1880; Trans. Conn. Acad., v, p. 377, pl. 36, figs. 1, 2, 1881.

Plate XL, figures 1, 1*a*.

The body of the female is smooth, depressed, about as broad as long; obtusely rounded posteriorly, not showing any lateral ridges nor dorsal papillæ. No cirrus above the eyes. Arms long, rather slender, tapering to long, slender, acute tips, the upper ones a little (2.5^{mm}) shorter than

those of the second pair, which are the longest; the third pair are about one-half inch (12mm) shorter than the second; the ventral pair about one-fourth inch (6mm) shorter than the third. In our specimen all the arms on the right side are somewhat shorter than those on the left, and the web between the 1st and 2d pairs is narrower, due perhaps to recovery from an injury. The web between the arms, except ventrally, is of about equal width, and scarcely more than one-fourth the length of the arms, measuring from the beak. Between the ventral arms the web is about half as wide as between the lateral.

The suckers are moderately large, alternating in two regular rows, except close to the mouth, where a few stand nearly in a single line; about fourteen to sixteen are situated on the part of the arms included within the interbrachial web. The whole number of suckers on one arm is upwards of seventy.

Color of the alcoholic specimen, deep purplish brown, due to very numerous crowded, minute, specks; eyelids whitish. The front border of the mantle, beneath, and the base of the siphon and adjacent parts, are white; end of siphon brown. Lower side of head and arms lighter than the dorsal side.

Total length, from posterior end of body to tip of arms, of 1st pair, 158mm; 2d pair, 160; 3d pair, 146; 4th pair, 133; to web between dorsal arms, 82; between ventral arms, 63; to edge of mantle, beneath, 30; to center of eye, 39. Breadth of body, 31; of head across eyes, 30; breadth of arms, at base, 55; diameter of largest suckers, 2.5; length of arms beyond web, 1st pair, 76; 2d pair, 82; 3d pair, 71; 4th pair, 69mm.

Two specimens of this species, both females, have been obtained. The first was from Le Have Bank, off Nova Scotia, in 120 fathoms, taken by Capt. John McInnis and crew, of the schooner "M. H. Perkins", October, 1879 (lot 530); the second was taken by Capt. David Campbell and crew, of the schooner "Admiral", near the Grand Bank, north latitude, 44° 07′; west longitude, 52° 40′, in 200 fathoms, December, 1879 (lot 590).

This species resembles *O. Grönlandicus*, of which the males alone have been described, and it may eventually prove to be the female of that species.

This species is easily distinguished from *O. Bairdii*, by its more elongated body, its much longer and more tapered arms, with shorter web; by the absence of the large, rough, pointed papillæ, or cirri, above the eyes, and by its general smoothness. The white color of the underside of the neck, siphon, and mantle-border also appears to be characteristic.

Octopus rugosus Bosc.

I have seen several specimens of a large *Octopus*, allied to *O. vulgaris* of Europe, which were taken at Beaufort, N. C., and near Fort Macon. It is probably *O. rugosus*.

Family CIRRHOTEUTHIDÆ Keff.

Kefferstein, in Bronn, Thier-Reich, iii, p. 1448, 1866.

Body somewhat elongated, furnished with a short, thick tapering fin on each side, supported by an internal transverse cartilage. Mantle extensively united to the head. Arms united nearly to the tips by a broad umbrella-shaped membrane or web. Suckers in a single row, alternating with slender cirri.

STAUROTEUTHIS Verrill.

Amer. Journ. Sci., vol. xviii, p. 468, Dec., 1879; Trans. Conn. Acad., v, p. 382, 1881.

Allied to *Cirrhoteuthis*, but with the mantle united to the head all around, and to the dorsal side of the slender siphon, which it surrounds like a close collar, leaving only a very narrow opening around the base of the siphon, laterally and ventrally. Fins long, triangular, in advance of the middle of the body. Dorsal cartilage forming a median angle, directed backward. Body flattened, soft, bordered by a membrane. Eyes covered by the integument. Web not reaching the tips of the arms, the edge concave in the intervals. Suckers in one row, with a pair of slender cirri, alternating with them, along most of the arm. Cirri absent between the basal and terminal suckers.

Stauroteuthis syrtensis Verrill.—(Finned devil-fish.)

Verrill, Amer. Journ. Sci., vol. xviii, p. 468, Dec., 1879; xix, p. 294, pl. 16, Apr., 1880; Trans. Conn. Acad., vol. v, p. 382, pl. 32, figs. 1–5, 1881.

Plate XXXVIII, figures 1–5.

Female: Head broad, depressed, not very distinct from the body. Eyes large. Body elongated, flattened, soft or gelatinous, widest in the middle, narrowed but little forward, but decidedly tapered, back of the fins, to the flat, obtuse, or subtruncate tail. The sides of the head and of the body, forward of the fins, are bordered by a thin soft membrane, about 12^{mm} wide. The fins are elongated, sub-triangular, obtusely pointed, placed in advance of the middle of the body, supported by internal cartilages which unite with a transverse dorsal V-shaped one, situated behind the fins. Siphon elongated, about 12^{mm} long, slender, round, with a small terminal opening. Mantle-edge so contracted and thickened around the base of the siphon as to show only a very small opening, and united to it in the middle line anteriorly or dorsally. Eyes large, distinctly visible through the integument.

Arms long, slender, sub-equal, each united to the great web by a broad membrane developed on its outer side, widest (about 38^{mm} or 1.5 inches) in the middle of the arm, while the edge of the web unites directly to the sides of the arms and, as a border, runs along the free portion toward the very slender tip. This arrangement gives a swollen or campanulate form to the extended web. Edges of the web incurved between the arms, widest between the two lateral pairs of arms. The

arms bear each fifty-five or more suckers, in a single row. Those in the middle region are wide apart (12mm or more) with a pair of slender, thread-like cirri, about 25 to 32mm long, midway between them. The cirri commence, in a rudimentary form, between the 5th and 6th suckers, on the dorsal arms, and between the 7th and 8th, on the lateral and ventral ones. They cease before the 23d sucker on the dorsal and lateral arms, and before the 22d on the ventral ones, which bear each 14 pairs of cirri. Near the mouth, and beyond the last cirri on the free portion of the arms, the suckers are more closely arranged. The jaws (figures 4, 5) have short, pointed and but little incurved tips; the cutting edges of both jaws have regularly curved outlines. They are small, with a deep cavity.

Beyond the last cirri on the dorsal arms there are 33 to 35 small suckers. The 2d arm on the right side appears to be imperfect. On this arm there are but 19 suckers beyond the last cirri; then follow 15, or more, minute, wartlike tubercles, extending to the tip. Color, in alcohol, generally pale with irregular mottlings and streaks of dull brownish; inner surface of arms and web, toward the base, and membrane around the mouth, deep purplish-brown.

Length from end of body to base of arms, 160mm; length to posterior base of fins, 63; to anterior base, 101; width across fins, 126; in advance of fins, 53 (not including lateral membrane); across eyes, 44; across end of tail, 30; diameter of eye, 30; width of fins, at base, 33; their length, 44; length of arms, 330 to 355; portion beyond web, 63 to 76. Edge of extended web, between upper arms, about 101; between lateral arms, about 203; entire circumference of web, about 1218mm, but its exact extent cannot be ascertained, because in our specimen the web between the ventral arms was badly torn.

The oviduct is single and nearly median, its orifice being a little to the left of the median line. A large nidamental gland, consisting of a posterior, yellowish portion, and a much larger, round, dark brown, anterior portion, surrounds the oviduct; the portion behind these glands is thin, tubular, and contains large round ova. The anterior portion, in front of the glands, is large and much thickened, and terminates in a slightly bilabiate orifice, at the base of the siphon. From the portion of the oviduct in front of the large glands, I took a large mature egg, covered with a hard, dark reddish brown case.

The egg, seen endwise, has a broad, elliptical outline, and while the two ends are truncated and smoothish, the sides are ornamented with numerous regular, roughened, elevated ribs. Greatest breadth of the egg, 11mm; thickness, 7mm; length, 6mm. The anal orifice is not raised on a distinct elevation. A small urethral papilla arises in front of the base of each gill.

The only known example of this remarkable species was taken by Capt. Melvin Gilpatrick and crew, schooner "Polar Wave", north latitude

43° 54′, west longitude 58° 44′, on Banquereau, about 30 miles east of Sable Island, Nova Scotia, in 250 fathoms. Presented to the U. S. Fish Commission, September, 1879. (Lot 472.)

Measurements of Stauroteuthis syrtensis.

	Inches.	Millimeters.
Length, posterior end to tip of dorsal arms	.....	.....
Length to tip of second pair	.....	.....
Length to tip of third pair	.....	.....
Length to tip of fourth pair	.....	.....
Length to edge of web between dorsal arms	.....	.....
Length to base of dorsal arms	6.30	160
Length to center of eye	5.75	146
Length to anterior base of fin	4.00	101
Length to posterior base of fin	2.70	68
Length to outer end of fin	3.75	95
Breadth across fins	5.00	126
Breadth of fins at base	1.30	33
Breadth of body in middle, excluding border	2.10	53
Breadth of body, with membranous border	3.00	76
Breadth of head across eyes	1.75	44
Breadth of eye	1.00	25
Length of arm-tips beyond last cirri, first pair	4.00	101
Length of arm-tips beyond last cirri, second pair	4.00	101
Length of arm-tips beyond last cirri, third pair	4.25	108
Length of arm-tips beyond last cirri, fourth pair	3.50	89
Length of longest cirri	1.25	32
Length of siphon	.50	12.5
Its breadth	.20	5
Upper mandible, total length	.52	13
Its height	.36	9
Beak to posterior lateral border of alæ	.16	4
Height of palatine lamina	.32	8
Lower mandible length	.40	10
Its height	.38	9.5
Beak to posterior border of alæ	.24	6
Beak to inner end of alæ	.30	7.5
Breadth (or depth) of gular lamina	.20	5

SUPPLEMENT.

After the preceding pages were put in type, a number of additional specimens were received, some of them of great interest. Among these there are some forms that appear to have been previously unknown. These are, therefore, described in this place. Moreover, several papers have been published, on the same subject, during the printing of this report. Some of these include certain of the species above described, and, therefore, may well be noticed here.

ARCHITEUTHIS Harting, 1861. (See pp. [25], [114].)

Architeuthus Steenstrup, Förhandl. Skand. Naturf., 1856, vii, p. 182, 1867 (no description)

Plectoteuthis Owen, Descriptions of some new and rare Cephalopoda. Part II. < Trans. Zool. Soc. London, xi, part 5, p. 156, pl. 34, 35, June, 1881.

Professor Owen, in the paper quoted, has given a somewhat detailed description, with figures, of the large cephalopod arm, long preserved in the British Museum. This arm had previously been pretty fully described by Mr. Saville Kent, in 1874, whose description has already been quoted by me. (See pp. [57–59].) Professor Owen, like Mr. Kent, fails to state to which pair of arms the specimen belongs. This is a very important omission, for in *Architeuthis*, as in many other genera, the arms belonging to different pairs differ in form and structure. The describers of this arm would, doubtless, have been able to ascertain to which pair it belongs by a direct comparison with the arms of *Ommastrephes*, or any other related form. For this arm, Professor Owen endeavors to establish a new genus and species (*Plectoteuthis grandis*). The genus is based mainly on the fact that there is a marginal crest along each outer angle, and a narrow protective membrane along each side of the sucker-bearing face. These peculiarities are precisely those seen in the *ventral arms* of *Architeuthis*, and have already been described by me in former articles, and in this report (see pp. [35], [37], [44]), both as found in *A. Harveyi* and *A. princeps*. Similar membranes or crests are found on the *dorsal* arms of *Sthenoteuthis pteropus* (see Pl. XVII, fig. 7 *a*), and other related species.

The suckers on the arm, as described and figured by Professor Owen, are like those of *Architeuthis*. Therefore there is no ground whatever for referring this arm *to any other genus*, and *Plectoteuthis* must become a synonym of *Architeuthis*.

Whether the arm in question belongs to a species distinct from those already named, I am unable to say. There is, apparently, nothing to

base *specific* characters upon, except the form of the suckers and of their horny rings. But the description of the horny rings is not sufficiently precise, nor the figures sufficiently detailed to afford such characters. If the arm is one of the ventral pair, as seems probable, the suckers, as figured by Professor Owen, and especially as more fully described by Mr. Kent, are of the same form, and agree closely, but not perfectly, with those of either of the Newfoundland specimens, for in the latter the suckers of the ventral arms are not denticulated on the inner side, or but slightly so. But they also agree well with those of *Architeuthis Hartingii*, as figured by Harting. Those of the original *A. dux* Steenst. have neither been described nor figured.

As this arm cannot, at present, be referred with certainty to any of the named species, it may be best to record it as *Architeuthis grandis*, until better known.

In the same article, Professor Owen has given a good figure (pl. 33, fig. 2) of the tentacular arm of the Newfoundland specimen (my No. 2), copied from the same photograph described by me (see pp. [6], [33], [34]). To this he applies, doubtless by mistake, the name, *Architeuthis princeps*,* without giving any reason for not adopting my conclusion that it belongs to *A. Harveyi*. But he does not, in any way, refer to the latter species, although he mentions the specimen (my No. 5), or rather the photograph of the specimen, on which that species was based. He apparently (p. 162) supposes that both photographs and Mr. Harvey's two series of measurements refer to the same specimen, which is by no means the case, as had been sufficiently explained by me, in several former papers.†

The brief account, given by Professor Owen, of the large cephalopods described by others, includes none additional to those noticed by me in this report. On the other hand, he omits those described by Harting; those described by Mr. Kirk, from New Zealand; those from Alaska; and several others.

* By a singular mistake, Professor Owen, on p. 163, states that this species was named *A. princeps* by Dr. Packard, in February, 1873. But according to his own statement, on p. 161, the specimen was not actually obtained till December, 1873, *at least nine months after* Dr. Packard's article was printed. In truth, the name *princeps* was first given by me, in 1875, to designate a pair of large jaws, as explained on p. 41. Neither this nor any other name appears on the cited page of Dr. Packard's article, though he elsewhere referred it doubtfully to *A. monachus*.

† It seems incredible that Professor Owen could have made these mistakes had he examined either of my former papers in which these specimens have been described in detail, not only from the photographs but also from the preserved specimens. He does, however, refer to my detailed paper in the Trans. Conn. Acad., vol. v. But as he states (p. 162) that in it a "brief notice is given of Mr. Harvey's squid," it is fair to suppose that the reference is taken at second hand, for it is not to be supposed that he would have considered my description, covering over sixteen pages, and accompanied by five plates, as a "*brief notice*." None of my earlier papers are referred to, nor does he mention the large species, *Moroteuthis robusta*, in his account of the large cephalopods hitherto described.

I have heard of but one authentic instance* of the occurrence of specimens of this genus at Newfoundland, since the finding of the small specimen (No. 24), in April, 1880. (See pp. [18], [34–40].)

The latest specimen (No. 27) was taken at Portugal Cove, Newfoundland, November 10, 1881. According to a description in the New York Herald, of November 25th, this specimen was nearly perfect, and had been shipped to New York, packed in ice. The following measurements of the fresh specimen were given on the authority of Inspector Murphy, chief of the Board of Public Works Department: Length of body, 5.5 feet; length of the head, 1.25 feet; total length, to end of tentacular arms, 28 feet; circumference of body, 4.5 feet; breadth of caudal fin, about 1.25 feet. A photograph of this example was made by Mr. E. Lyons, of St. Johns. This specimen is considerably smaller than the Logie Bay specimen (No. 5), but if in as good preservation as stated, it will, when it can be studied, give an opportunity to complete the description of the head, eyes, and certain other parts that have not been seen in good condition in any of the previous specimens.

STHENOTEUTHIS Verrill, 1880. (See p. [99].)

Ommatostrephes Steenstrup, Overigt K. D. Vidensk. Selsk. Forh., p. 89, Aug., 1880; the same, March, 1881.

Xiphoteuthis (subgenus) Owen, op. cit., p. 104, pl. 28, figs. 1, 2, June, 1881 (*non* Huxley).

This generic group has been discussed by Professor Steenstrup in two recent papers,† published during the printing of this report. In the first paper quoted,‡ Professor Steenstrup gives figures (cuts) which, with the descriptive remarks, will hereafter enable others to identify his *Ommatostrephes pteropus* with more certainty. He has given diagramatic cuts of the base of the tentacular clubs, showing the arrangement of the connective suckers and tubercles of *O. pteropus*, *O. Bartramii*, *O. gigas*, *O. pelagicus*, *O. oualaniensis*, and *Dosidicus Eschrichtii* (p. 11), and cuts (p. 9), showing the siphonal grooves of *O. pteropus*, *O. Bartramii*, *O. pacificus*, *Todarodes sagittatus* (="*O. todarus*"), and *Illex Coindetii* (="*O. sagittatus*," auth.). On pp. 19 and 20 he has given a synoptical table of the several genera that he recognizes in this group, which he names, *Ommatostephini* (= *Ommastrephidæ* Gill, Tryon, Verrill). On plate 3, he figures "*Illex Coindetii*," female, with the gill-cavity opened, showing a

*A purely fictitious and sensational account of an imaginary capture of an *Architeuthis* has been published in Lippincott's Magazine, for Aug., 1881, p. 124, by Mr. Charles F. Holder.

†De Ommatostrephagtige Blæksprutter indbyrdes Forhold. <Oversigt K. D. Vidensk. Selsk. Forhandl., 1880. Presented April, 1880. [Author's edition received Aug., 1880.]

Professor A. E. Verrils [*sic*] to nye Cephalopodslægter, Sthenoteuthis og Lestoteuthis. Bemærkninger og Berigtigelser, 1 pl. ["avec un résumé en Francais," not received]. From the same, 1881. Advance copy, received by me, through the kindness of the author, is dated, in MSS, March 3, 1881.

‡The part of this paper relating to the nomenclature of the genus *Ommastrephes* (*Illex* Steenst.) has already been discussed on pp. [82], [83].

large cluster of spermatophores attached to the inner surface of the mantle, behind the base of the gill, and a smaller one, in front of the gill.

In the second article referred to above, Professor Steenstrup discusses the genus *Sthenoteuthis* versus "*Ommatostrephes.*" He recognizes the identity of *Sthenoteuthis* and his restricted genus *Ommatostrephes*, as well as the priority of date of the former. He also refers to *S. megaptera* as "*Ommatostrephes megaptera.*"

In the last paper* quoted above, Professor Owen has described a cephalopod, without locality, under the name of *Ommastrephes ensifer*, for which he proposes the subgeneric name, *Xiphoteuthis*. The latter name is, however, preoccupied. His species is a typical example of my genus *Sthenoteuthis* (1880), and appears to be identical in every respect with *S. pteropus* (see my Plate VII, figs. 2, 2*a*, and Plate XVII), as described by me. But Professor Owen fails to mention one of the most characteristic features of this group of squids, viz, the connective tubercles and smooth suckers on the proximal part of the tentacular club. Nor is his figure sufficiently detailed to indicate this character, nor even the actual arrangement and structure of the other suckers of the club. The high median crest and broad marginal web of the third pair of arms are well shown, but these are about equally broad in *S. pteropus* and *S. megaptera*, and are also present in all the related species of this group.

Owen's specimen had a total length of 3 feet; length of body 15 inches; of head to base of dorsal arms, 3.7; of third pair of arms, 12; of tentacular arms, 21; breadth of caudal fin, 12.6; length of their attached base, 6.6; breadth of body, 5; length of first, second, third, and fourth pairs of arms, 8.9, 11, 12, and 9.6 inches, respectively. The specimen is a female. It agrees very closely in size with the Bermuda specimen described by me, and its proportions do not differ more than is usual with alcoholic specimens of any species preserved under different circumstances, and in alcohol of different strength. The original specimen of *S. megaptera* is considerably larger.

Ommastrephes illecebrosus V. (See p. 83.)

This species was taken in many localities this year by the U. S. Fish Commission, in deep water, off Martha's Vineyard. Most of the living specimens were young, but large ones were often taken from the stomachs of bottom-dwelling fishes, in the same region, showing conclusively that it regularly inhabits those depths.

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*Among the other species figured and described in this paper, there is a handsome species from the China Sea, described as *Loligopsis ocellata*, sp. nov. (pp. 139–143, pl. 26, figs. 3–8; pl. 27, figs. 1, 2). This is evidently not a true *Loligopsis*, and belongs, in all probability, to my genus *Calliteuthis*. It agrees very closely, even to the coloration and the form of the fins and pen, with my *C. reversa*, but differs in having serrated suckers. It is much larger than my specimen, but, like the latter, had lost the tentacular arms. This species should, therefore, be called *Calliteuthis ocellata*. The genus probably belongs to the Chiroteuthidæ.

Additional specimens examined.

Station.	Locality.	Fathoms.	Date.	Received from.	No of specimens and sex.
	Off Martha's Vineyard.		1881.		
918	S. ¼ W., 61 miles from Gay Head	45	July 16	U. S. F. C.	1 l., from fish.
919	S. ¼ W., 65 miles from Gay Head	51½	July 16	do	2 l., from Lophius.
923	S. ¼ W., 78½ miles from Gay Head	96	July 16	do	3 juv.
924	S. ¼ W., 83½ miles from Gay Head	110	July 16	do	5 juv.
925	S. ¼ W., 86 miles from Gay Head	224	July 16	do	1 juv.
939	S. by E. ½ E., 98 miles from Gay Head	258	Aug. 4	do	1 l.; 1 juv.
940	S by E. ½ E., 97 miles from Gay Head	130	Aug. 4	do	1 l.; 1 juv.
949	S. W., 79½ miles from Gay Head	100	Aug. 23	do	1 l., in Lopholatilus.
1025	S. S. W. ¼ W., 95 miles from Gay Head	216	Sept. 8	do	1 l., in fish.
1033	S. S. E. ½ E., 106 miles from Gay Head	183	Sept. 14	do	1 l., in Merlucius.
1038	S. by E. ½ E., 89½ miles from Gay Head	146	Sept. 21	do	1 l.
	Newfoundland	Surface.	1880.	H. L. Osborn	3 l. ♂; 10 l. ♀.

Mr. H. L. Osborn, in the American Naturalist, vol. xv, p. 366, May 1881, has given an account of the habits of this squid, at Newfoundland, and of the methods of capturing it there for bait.

Enoploteuthis Cookii Owen. (See p. [53].)

Trans. Zool. Soc. London, xi, p. 150, pl. 30, figs. 1–3; pl. 31, figs. 1–4; pl. 32, figs. 1–6; pl. 33, fig. 1 (restoration), June, 1881.

Sepia unguiculata Molina, 1810 (no description).

Enoploteuthis Molinæ D'Orbigny, Ceph. Acétab., p. 339.

? Enoploteuthis Hartingii Verrill, this vol., p. [53], pl. 12, fig. 4; pl. 15, fig. 5, 1880.

Professor Owen has very recently described in detail, and has given excellent figures of most of the existing parts of this large and remarkable cephalopod, which have been preserved so long and have so often been referred to, but hitherto have never been scientifically described, (see p. [53]). It is to be regretted, however, that Professor Owen has neither described nor figured the dentition of the radula in a manner to enable it to be used as a systematic character. His statement in regard to it is of the most general kind, and shows only that there are seven rows of teeth. It is also a matter of surprise that he has not compared any of the portions described with the corresponding parts of the equally large and very closely allied *Enoploteuthis*, carefully described and figured by Harting in 1861 (see p. [53]), and to which I have given the well-merited name, *E. Hartingii*. It is not improbable that the two forms are really identical, but this cannot be certainly determined from the figures, because the corresponding parts are not always represented in the same positions, and it is uncertain whether the corresponding arm is preserved in the two cases. Harting figures, rather poorly, the teeth of the radula, which appear to be very peculiar, if his figure is correct, (see my Plate XV, fig. 5, *c*, *d*).

The shape of the mandibles appears to be different in the two species, however, and the large hooks also differ in form.

LESTOTEUTHIS V.=**CHELOTEUTHIS** V.=**GONATUS** Steenst. (*non* Gray).

The second of Professor Steenstrup's recent papers* contains a detailed discussion of *Gonatus Fabricii* Steenst., with which he also unites *Onychoteuthis Kamtschatica* Midd., the type-species of my genus *Lestoteuthis* (see p. [70]). He may be correct in uniting these forms, for he states that he has received specimens that agree with *Gonatus Fabricii*, from the North Pacific.† Moreover, taking the characters of the genus *Gonatus*, as *now understood*, by Professor Steenstrup, the description and figures of Middendorff's species apply well to that genus, and my description of *Lestoteuthis* well defines *Gonatus* Steenst., except for the mistake in regard to the tip of the pen. But when I proposed the genus *Lestoteuthis*, no writer had ever so described *Gonatus*, and the data necessary for the correlation of the two species *did not exist* in the literature of the subject. I have already alluded (p. [79] and elsewhere) to some of the very serious errors of Gray, H. & A. Adams, and others, as to the *generic* and even *family* characters of *Gonatus*.‡ Professor Steenstrup, in his last paper, has exposed a greater number of errors, some of which are questionable. He has, however, been fortunate in securing specimens of larger size and in better condition than those examined by other writers, and has given good figures and a very full exposition of the characters of this very interesting species. Two excellent specimens were taken by our party, this season, on the "Fish Hawk." One of these is an adult male; the other is young, with the mantle 30^{mm} long. The latter agrees well in size and form with the specimen described and figured by G. O. Sars, as *Gonatus amœnus*, while the former agrees with Steenstrup's figure of the adult *G. Fabricii*. But both differ decidedly from a Cumberland Gulf specimen, which is doubtless the *real Gonatus amœnus* Gray, and has four rows of true suckers on all the arms, and no hooks. It does not appear that Steenstrup has seen this form.

The fortunate acquisition of these specimens has enabled me to ascertain, for myself, not only that Professor Steenstrup is correct in considering two of the forms that have been described from the North Atlantic as simply the young and adult of the same species, but also that all the

* See note on p. [200].

† The figures, however, show differences in the form of the pen and caudal fin, which, if correct, may still indicate specific differences.

‡ The genus *Gonatus*, as established by J. E. Gray, if we judge by his description, was a very different group from what Steenstrup understands by it. Among the false characters given by Gray are the following: 1, It was said to have no eyelids; 2, to have no valve in the siphon; 3, to have no siphonal dorsal band. But he also says that it has nearly equal and similar suckers in four series, on all the arms, "all with small circular rings"; and the club was said to have "ranges of small, nearly sessile, equal-sized cups," with one "large sessile cup, armed with a hook in the middle of the lower part." From the fact that he received his specimens from Greenland (coll. Möller), we must believe that he actually had before him the real *G. amœnus*. My specimen from Cumberland Gulf has the suckers as described by Gray, *on all the arms*.

Most of Gray's errors have been copied and adopted by Woodward, H. & A. Adams, Gray, and many other writers.

essential and peculiar features of the armature, both of the sessile and of the tentacular arms, including the special, lateral connective suckers and tubercles of the club, are present, though minute, even in the very young individuals, such as described by G. O. Sars. The fact that these characters have been overlooked is undoubtedly due, in many cases, to the imperfectly preserved specimens that have been examined. This was, at least, the case with the only American specimens seen by me until this year. They had all been taken from fish stomachs, and had lost more or less of their suckers and hooks.

A careful and direct comparison of the adult *G. Fabricii* with the mutilated specimen which was last year described by me as *Cheloteuthis rapax*, has convinced me that they are identical, and, therefore, *Cheloteuthis* becomes a synonym of *Lestoteuthis*. Two of the characters, viz: the supposed presence of two central *rows of hooks* on the ventral, as well as on the lateral arms, and the supposed *absence* of the small marginal suckers on the lateral arms, relied upon for characterizing *Cheloteuthis*, were doubtless due to post-mortem changes. The ventral arms had lost the horny rings of the suckers, and the soft parts had taken a form exceedingly like that of the sheaths of the hooks of the lateral arms. But by the careful use of reagents, I have been able to restore the original form of some of the distal ones sufficiently to show that they actually were sucker-sheaths. The third character, originally considered by me as more reliable and important, was the existence of the peculiar, lateral connective suckers and alternating tubercles on the tentacular club. This is *now* shown by Professor Steenstrup to be a character of his *Gonatus*. But no one had previously described such a structure in connection with that genus. Even in the recent and excellent work of G. O. Sars, in which "*G. amœnus*" is described in some detail, and freely illustrated, there is no indication of any such structure, although the armature of the club is figured (see my Plate XV, fig. 1*b*), nor is the difference between the armature of the ventral and lateral arms indicated.*

I add a new description of the genus *Lestoteuthis*, and also of my largest example of *L. Fabricii*.

LESTOTEUTHIS Verrill (revised). (See pp. [70], [78].)

Gonatus Steenstrup, op. cit., pp. 9–26 (*non* Gray).
Gonatus Verrill, Trans. Conn. Acad., v, pp. 250, 290, 1880 (*non* Gray).
Lestoteuthis Verrill, Trans. Conn. Acad., v, p. 250, Feb., 1880; p. 390, Oct., 1881.
Cheloteuthis (*Chiloteuthis* by typ. error) Verrill, Trans. Conn. Acad., v, p. 292, Jan., 1881.
Cheloteuthis Verrill, Bulletin Mus. Comp. Zool., viii, p. 109, March, 1881.

Odontophore with only five rows of teeth. Mandibles very acute, strongly compressed. Lateral connective cartilages of the mantle are

* According to Gray, in *Gonatus* all the sessile arms bear four rows of similar and nearly equal suckers; according to G. O. Sars they all have two central rows of sucker-hooks. My former description was based mainly on the figures and description of G. O. Sars, my only specimen, at that time, being an imperfect young *Lestoteuthis*, like that of Sars.

simple ridges; those of the siphon ovate. Nuchal olfactory crests one or more on each side, longitudinal. Caudal fin of adult, large, spear-shaped. Ventral arms with four rows of denticulated suckers. No trace of hectocotylization detected.* Lateral and dorsal arms with two marginal rows of small suckers and two median rows of larger hooks. Tentacular arms with a central row of hooks, the two distal ones largest; with a large distal and two lateral groups of small suckers, in numerous rows; and with a lateral group of peculiar connective suckers, alternating with tubercles, near the lower margin, and a row of smaller ones extending for a long distance down the margin of the arm; upper margin of the arm with a band of small, pediceled suckers along about half its length. Pen narrow, with a short, hollow, posterior cone.

Gonatus Gray, typical (*non* Sars, Steenst.), differs in having on all the arms four rows of true suckers, all of which are similar, and have the marginal ring divided into a series of several sharp denticles on the higher side. This may be a sexual character, but the two forms should be kept separate, awaiting further evidence. Steenstrup does not give the sex of his specimens.

Lestoteuthis Fabricii (Fabr.) Verrill. (See pp. [76], [79].)

? Onychoteuthis Kamtschatica Middendorff, 1849.

Gonatus Fabricii Steenstrup (*pars*), in Mörch, Faunula Molluscorum Ins. Færöerne, <Vid. Meddel. nat. For., 1867, p. 102; Faunula Mollusc. Islandiæ, <Vid. Meddel. nat. For., Kjöbenhavn, 1868, p. 227.

Gonatus Fabricii Mörch (*pars*), in T. R. Jones, Arctic Manual, p. 130, 1875. Steenstrup, Oversigt over d. Kongl. D. Vidensk. Selsk. Forh., 1881. [Sep. copy, p. 26], pl. 1, figs. 1–7.

Verrill, (*pars*) Trans. Conn. Acad., v, p. 291; this vol., p. [79].

Cheloteuthis rapax Verrill, Trans. Conn. Acad., v, p. 293, pl. 49, figs. 1–1f; Bulletin Mus. Comp. Zool., viii, p. 110, pl. 2, figs. 1–1f, 1881.

Plate XV, fig. 1–1*c*, 2–2*d*, 3–3*f*, 4. Plate XLV, fig. 1–1*d*.

Body elongated, tapering to an acute posterior end; anterior edge of mantle nearly even dorsally, with a slight median emargination; lateral angles well-marked, in line with the internal connective cartilage, which forms a long, simple, longitudinal ridge. Caudal fin broad, spear-shaped, broadest in advance of the middle; the lateral angles are well rounded; the tip is very acute; the anterior lobes are broadly rounded, projecting forward beyond the insertion. Head large, short, and broad; eyes large, occupying most of the sides of the head; eye-lids well developed, thickened, with a narrow, oblique sinus. Siphon large, in a deep groove, with two stout, dorsal bridles; lateral connective cartilages large, long-ovate, posterior end broadest. One olfactory crest on each side, behind the eye, in the form of a low, longitudinal membrane; slight indications of another, lower down; a small, fleshy, flattened, projecting papilla near the auditory opening. The outer buccal mem-

* My largest specimen, although apparently adult, is not sexually mature. An older specimen might be hectocotylized.

brane has seven distinct angles. Arms rather long and strong; trapezoidal in section. The dorsal arms are considerably shorter than the others; order of length is 1, 2, 4, 3; the third is but little longer than the second pair; ventral arms decidedly more slender than the others.

Ventral arms with four rows of denticulated suckers (Plate XLV, fig. 1*c*), those of the two inner rows larger; lateral and dorsal arms with two marginal rows of small suckers and two inner rows of larger incurved hooks, inclosed, except at the sharp tips, in muscular sheaths, which have lateral basal expansions and short pedicels. (Plate XLV, fig. 1*b*.) Tentacular arms* long and strong, quadrangular; in my specimen they reach back beyond the base of the fin; the club is large and broad, with a long, narrow distal portion, having a strong dorsal keel; in the middle are two very large, curved hooks (figs. 1, 1*a*), the distal one smaller; proximal to these there is a row of five smaller hooks, decreasing proximally, and between these and the large hooks there is, on one arm, a single small sucker, on the other arm a single sucker takes the place of the proximal hook, while an odd, small sucker stands to one side of the row; along the upper margin of the club there is a broad band of small, denticulated suckers, on long pedicels, arranged in oblique, transverse rows of five or six; this band of suckers is interrupted opposite the large hooks; beyond the hooks a large group of similar small suckers covers nearly the whole distal portion of the club (Plate XLV, fig. 1); at the tip of the club there is a circle of small smooth suckers; along the lower margin of the middle portion of the club there is a band of small suckers, like those on the other margin; along the basal third of the margin and supported on a thickened marginal expansion of the club, there is a row of six special, smooth, connective suckers, at the inner ends of transverse, muscular ridges (fig. 1*e*); between and alternating with these suckers, there are deep pits and as many small, round tubercles, destined to fit the suckers and ridges of the other club; continuous with these a row of similar, but smaller, sessile, connective suckers and tubercles extends down along the margin of the inner face of the arm, for about half its length, becoming smaller and more simple proximally; an irregular band, formed of two or three rows of small, pediceled and denticulated suckers, extends down the other margin of the arm, with some scattered ones along the middle.

The pen (Plate XLV, fig. 1*d*) is thin, long and narrow; anterior part about half as wide as the middle portion, slender, concave, with thickened margins; the anterior end is very thin, acute; the two marginal ribs converge gradually, as they run backward, and unite near the posterior end; the widest part of the pen is a little behind the middle; the thin margins begin at about the anterior third, gradually increasing in

*The figure given (Plate XV, fig. 3) of the somewhat injured tentacular club of the type of *Cheloteuthis rapax* represents the structure nearly correctly, but many of the small suckers and tubercles on the arm, below the club, had been destroyed, the edge above *e'* is injured, and of the large hooks (*a*, *a'*) only the sheaths remain.

width to the widest part, when they still more gradually decrease posteriorly; but toward the end they expand into the obliquely hooded portion, or terminal hollow cone; this portion is strengthened by a dorsal mid-rib, and by numerous small ribs which radiate forward from the tip, one on each side being stronger than the rest. In life, the cone contained part of the testicle, and at the tip a cartilaginous core. Length of pen, in alcohol, 133mm; greatest breadth, 7mm; of shaft, 2.5mm; length of cone, on shortest side, 7mm.

General color of body, fins, head and arms, deep reddish brown, tinged with purple; back darkest; the color is due to large chromatophores rather uniformly and closely scattered over the whole surface; on the arms and siphon they are smaller, but they cover all the surfaces of the arms, except the lower side of the tentacular arms and the face of the club. Total length, 263mm (10.25 inches); length of mantle, 153mm (6 inches); length of dorsal arms, 57mm; of 2d pair, 71mm; of 3d pair, 77mm; of 4th pair, 70mm; of tentacular arms, 100mm; length of fin, from insertion, 63mm; from anterior lobe, 70mm; greatest breadth, 68mm, breadth of head, 29mm.

Notes on the visceral anatomy of the male.

In its anatomy this species resembles *Ommastrephes*. The branchial cavity is very large, extending back nearly to the base of the fin; the median longitudinal septum is far back, gills very long, but not reaching the margin of the mantle, attached nearly to the tip; its structure is like that of *Ommastrephes*. Liver orange-brown, very large, massive, nearly as in *Ommastrephes*, but larger, extending back farther than the base of the fin. The circulatory and renal systems are similar to those of *Ommastrephes*, in most respects. The posterior aorta goes back some distance before it divides, about opposite the base of the fin, into the medio-ventral artery of the mantle, and a caudal artery. Two large ventral renal organs lie below and to each side of the heart, and blend together, in front of it, into a large mass, which has a pointed lobe extending forward; posteriorly two lobes extend back, as usual, along the posterior venæ-cavæ. The first stomach is rounded and the second stomach is a large, long-pyriform sac; the intestine is long; the ink-sac is long-pyriform. The reproductive organs are small, indicating that the specimen is still immature, and probably only one year old. The spermary or "testicle" is small (length 18mm, diameters 2mm and 4mm), flattened, tapering backward, partly inclosed by the hooded portion of the pen, and with the anterior end attached laterally to the posterior end of the cæcal lobe of the stomach. The prostate gland, vesiculæ-seminales and spermatophore-sac are small; the efferent duct is long and slender, extending forward over and beyond the base of the left gill.

MOROTEUTHIS Verrill. (See pp. [65], [70].)

Type, *Onychoteuthis* (or *Lestoteuthis?*) *robusta*, Trans. Conn. Acad., v, pp. 246–250.
Moroteuthis Verrill, Trans. Conn. Acad., v, p. 393, Oct., 1881.

After referring the type of *Lestoteuthis* to *Gonatus* (not of Gray), Professor Steenstrup admits that the gigantic species, *L.* (*?*) *robusta* V., is the representative of a distinct genus, to which he would restrict the name, *Lestoteuthis*.

But *L. Kamtschatica* was especially given by me as *the type of Lestoteuthis*, and the characters of the genus were derived entirely from that species, while *L. robusta* was referred to it only with great doubt, owing to the fact that its armature is almost unknown. Therefore, if *Lestoteuthis* hereafter becomes a complete synonym, it should be dropped, when it cannot be kept for its special type-species. For the gigantic species, I proposed (Amer. Journ. Sci., vol. xxii, p. 298, Oct., 1881) a new genus, *Moroteuthis*.

This genus will have, as known characters: A long, narrow, thin pen, terminating posteriorly in a conical, hollow, many-ribbed, oblique cone, which is inserted into the oblique, anterior end of a long, round, tapering, acute, *solid*, cartilaginous terminal cone, composed of concentric layers, and corresponding to the solid cone of *Belemnites* in position and relation to the true pen; elliptical connective cartilages on the base of the siphon; nuchal, longitudinal crests, three, much as in *Ommastrephes;* eye-lids with a distinct sinus; caudal fin large, broad, spear-shaped; ventral arms with smooth-rimmed suckers at the base. The rest of the armature is unknown.

Moroteuthis robusta is the only known species.

Chiroteuthis lacertosa Verrill. (See p. [119].)

Chiroteuthis Bonplandii? Verrill, Trans. Conn. Acad., v, p. 299 (*non* Verany).
Chiroteuthis lacertosa Verrill, Trans. Conn. Acad., v, p. 408, pl. 56, figs. 1–1*f*, Nov., 1881.

Plate XLVI, figs. 1–1*f*.

A nearly complete male specimen of a *Chiroteuthis*, lacking only the tentacular arms and the distal portion of the left ventral arm, was received after the preceding pages were put in type. The stumps of the tentacular arms, remaining, bear the same kind of unarmed sessile suckers as did the arm described on p. [119], and figured on Plate 32, figs. 1–1*b*. It appears to be a new species, and is very distinct from *C. Bonplandii*. The sessile arms are very large in proportion to the head and body, and the ventral arms are much larger than any of the others. The body is small, obconic, tapering rapidly backward to the origin of the caudal fin, where it becomes very small, and continues to taper to the very slender posterior end. The median dorsal angle of the mantle-edge projects far forward, as a broad angular lobe; lateral angles rounded and not prominent. Caudal fin relatively large, as compared with the body, broad-ovate in outline, widest near the middle, tapering backward to an acuminate, slender tip; very broadly rounded laterally,

narrowing abruptly anteriorly; the anterior lobes are small, rounded, and project only slightly forward beyond the insertions. Siphon large, with a well-formed valve, far back from the orifice; dorsal bridles rudimentary. Connective cartilages on the base of the siphon, broad-ovate, ear-shaped, with two rounded prominent lobes projecting into its concavity, one posterior, the other ventral, so that the pit is three-cornered (fig. 1*b*). The corresponding connective cartilages of the mantle consist of two pits, separated by a prominent, triangular tubercle (fig. 1*c*). Head large, in proportion to the body, tapering backward from the bases of the arms. Eyes large; lids thin and simple, without a distinct lachrymal sinus. Behind and below each eye is a long (4^{mm}), slender, clavate papilla (fig. 1*f*), probably olfactory in function.

The sessile arms are large and, except the ventral, unusually rounded; the inner or sucker-bearing faces are much less differentiated than usual, scarcely differing from the other sides in color, and bordered by only a slight or rudimentary membrane on each side; the rounded prominences from which the sucker-pedicels arise are also colored and not much raised. The dorsal arms are rather long and tapering, but much shorter and smaller than the others, slightly compressed, and with a slight median crest distally. The next pair are similar in form and structure, but considerably longer and larger. The third pair are much longer and larger, with the outer angles well rounded, and a strong median crest extends nearly to the base, but is wider distally, where the arms are strongly compressed. The ventral arms are considerably longer and stouter than the third pair, and very different from all the others in form; they are strongly compressed in the direction parallel with the median plane of the head, and have the lower and outer angles well rounded, and the sucker-bearing face wide and scarcely differentiated from the lateral faces; but on the superior lateral side there is a wide and thick crest running the whole length of the arms, giving them a strongly and obliquely compressed appearance. The suckers on the ventral arms are smaller, fewer, and more distant than on any of the others; those at the bases are largest and three or four stand nearly in a single row; farther out, along the middle of the arm, they are distantly arranged in two rows and rapidly become small. The left ventral arm shows no signs of being hectocotylized; the right one, however, has lost half its length by mutilation. On all the other arms the suckers are regularly and much more closely arranged in two rows, and decrease more gradually in size from near the base to the tips.

The suckers *on all the arms* are similar in form; they are rather deep, narrowed at the rim, slightly constricted above the middle, and swollen below, and very oblique at the base; the pedicels are slender and nearly laterally attached; the horny rings are very deep and oblique, and strongly denticulated on the outer or higher side, but on all the arms they are *smooth on the inner side;* the median, outer denticles are long, slender, close together; laterally they become shorter, broader, acute-

triangular and curved forward. On the larger suckers (Plate XLVI, figs. 1*d*, 1*e*) the outer teeth are obtuse, but on the distal ones they become more slender and acute. The margins of the suckers are surrounded with small, elongated scales.

The buccal membrane is thin and much produced, with the angles little prominent; it is attached to the arms by eight thin, but wide, bridles, the two superior ones united together near their origin. The web between the arms is rudimentary but distinct. The pen (fig. 1*a*) is very unlike that of *C. Veranyi*, as figured and described by D'Orbigny. It has a long, narrow shaft, of nearly uniform width, and a long posterior portion, a little wider than the shaft, corresponding in length to that of the caudal fin; at the commencement, this portion expands into narrow, free, incurved margins, but these unite quickly so as to form a long, narrow, angular, tubular portion, tapering to a very slender tip; this portion (fig. 1*a''*) has a distinct dorsal keel, with a groove each side of it, two dorsal angles, and a ventral angle along each side; the narrow shaft has a dorsal keel, with the sides bent down abruptly, nearly at right angles, and a little incurved, so as to produce a squarish keel above, with a deep angular groove below, while the very narrow margins bend outward abruptly (fig. 1*a'*); the shaft increases very slightly in width, to near the subacute anterior end, but preserves the same form, and there is no distinct dilation of the margin anteriorly, such as D'Orbigny figures in the pen of *C. Veranyi*, nor does the posterior portion resemble his figure, though if split open and flattened out it would resemble it more nearly.

This specimen is an adult male, in the breeding condition, for its spermatophore-sac is much distended with spermatophores. The color is much like that of *C. Veranyi*. It is everywhere thickly specked with small, purplish brown chromatophores, except on the buccal membrane and the bases of the tentacular arms, where there are but few; the head, around the eyes, and the end of the siphon are darker; a row of very distinct, rather large, round, dark purple spots runs along the inner surface of the ventral arms, just outside of, and alternating with, the upper row of suckers, which they about equal in size.

Total length, to end of ventral arms, 383^{mm}; to end of third pair, 366^{mm}; to end of dorsal arms, 298^{mm}; tail to dorsal mantle edge, 125^{mm}; to base of dorsal arms, 178^{mm}; length of dorsal arms, 120^{mm}; of second pair, 150^{mm}; of third pair, 188^{mm}; of ventral, 205^{mm}; length of caudal fin, 60^{mm}; its greatest breadth, 41^{mm}; breadth of head at eyes, 20^{mm}; of dorsal arms, 7^{mm}; of third pair, 10^{mm}; of ventral arms, 13^{mm}; of bases of tentacular arms, 3^{mm}; diameter of largest suckers of lateral arms, 2.25^{mm}.

Brown's Bank, off Nova Scotia, taken from the stomach of a cod (lot 956). Presented to the United States Fish Commission by Capt. Wm. Dempsy and crew, of the schooner "Clara F. Friend," June, 1881.

The internal anatomy is somewhat peculiar in several respects, but will not be fully described in this place.

The gills are short and broad, with very long lamellæ. The reproductive organs occupy a large part of the visceral cavity. The testicle is a large, thick, broad-ovate organ, with the two sides folded together around and closely united to the large cæcal lobe of the stomach. The testicle does not extend back beyond the origin of the caudal fin, the visceral cavity being very narrow in that region. The prostate gland and vesicula seminalis are large and swollen, and the spermatophore-sac is also large. The efferent duct is large and long, extending far forward; it expands at the end into a spade-like form, with an acute tip; its orifice is oblique ear-shaped, situated on one side, near the end, and is protected by a lobe or flap. The stomach is saccular, and the large cæcal lobe is not very long. The liver is thick. The posterior aorta goes far back, nearly to the origin of the fin, before dividing, for the median septum of the branchial cavity is placed far back. The ink-sac has the ordinary pyriform shape.

A second smaller specimen, which proves to be a young female, in excellent preservation, was trawled by Lieut. Z. L. Tanner, on the "Fish Hawk," October 10, 1881. This was taken, off Delaware Bay, in 435 fathoms, (station 1048).

This specimen agrees nearly with the type-specimen, described above, in the form and proportions of the body, head, arms, caudal fin, pen, etc., and in the structure and denticulation of the suckers. The caudal fin is slightly broader in proportion, while the suckers are deeper and relatively smaller, especially those on the ventral arms, which are decidedly smaller than those on the lateral ones. They are finely and sharply denticulated on the outer edge, as in the type.

The color is, however, quite different, for in this example the skin and flesh are translucent and beautifully specked with regular, round, often rather large, not crowded, dark brownish red chromatophores; the larger of these, especially on the under side of the fin and body, are ocellated; on the head and arms the chromatophores become smaller and more crowded, more nearly as in the type. The row of large dark purple spots, along the ventral arms, are, in this example, decidedly raised and wart-like. One of the tentacular arms is perfect. These are very long and slender, and bear, along their whole length, relatively large rounded, wart-like, dark purple, sessile suckers having a small central pit. These suckers are about two-thirds as broad as the diameter of the arm, and from close to the base of the arm to the distal fourth they are separated by spaces mostly equal to about twice their diameter; distally they are less numerous. The tentacular club*

* This arm differs considerably from the one described on p. [119] and figured on Plate XXXII, figs. 1–1*b*, especially in having much more numerous sessile suckers along the whole length of the arm, and in having sharply denticulated suckers on the club. This may indicate that the latter belonged to a different species. But it is possible that the latter had suffered injury, before preservation, sufficient to cause these differences.

is well developed, with a broad marginal membrane along each side, having scolloped or notched edges. The club terminates in an ovate, subacute, dark purple, hollow organ, with its opening on the outer side of the arm. The suckers (Plate XLV, fig. 5) are regularly arranged in four rows. The stalk is long, with a dark purple, fluted summit surmounted by a very slender pedicel, bearing the sucker, which is hooded, with a lateral opening; the horny ring bears several slender, sharp teeth on the outer side, the central one being much the longest; the soft rim of the sucker is covered with many rows of small scales, the inner ones with acute tips. The lateral suckers do not alternate with the median, but the two arise close together, opposite each other, and in line with the teeth on the edge of the marginal membrane. The inner surface of the club is specked with brown chromatophores, and the marginal membranes are crossed by brown lines, corresponding to the notches in their edges.

Total length to end of ventral arms, 194^{mm}; to end of third pair, 150; to end of dorsal arms, 127; tail to dorsal mantle edge, 59; to base of dorsal arms, 86; length of dorsal arms, 41; of second pair, 56; of third pair, 69; of ventral, 110; of tentacular arms, 180; of club, 17; breadth of club, 5; length of caudal fin, 27; its greatest breadth, 24; of dorsal arms, 4; of third pair, 5; of ventral arms, 8; of bases of tentacular arms, 1.5; diameter of largest suckers of lateral arms, 1^{mm}.

This species differs widely from *C. Bonplandii* in the sessile arms, etc. It is much more nearly related to *C. Veranyi*, from which it differs decidedly in the pen; in the suckers; and in the caudal fin, if these parts are correctly described and figured, for the latter.

BRACHIOTEUTHIS Verrill.

Trans. Conn. Acad., v, p. 405, Nov., 1881.

Allied to *Chiroteuthis*. Differs in having the lateral connective cartilages of the siphon simple, long-ovate, and the corresponding cartilages of the mantle in the form of simple, linear ridges; a rhombic caudal fin; pen with a simple, linear, anterior portion, suddenly expanding into a much broader, lanceolate, posterior portion, which is naturally infolded; arms slender, the ventral ones not distinctly obliquely compressed; tentacular club without a spoon-like cavity at tip.

The siphon has a valve and dorsal bridle as in *Chiroteuthis*, and the suckers, so far as preserved, are similar, but those of the club are more numerous, and their pedicels apparently had a less prominent bulb below the sucker.

In addition to the type-species, this genus probably includes the *Chiroteuthis Bonplandii* Verany, from the eastern Atlantic.

C. Bonplandii, as figured, has a very similar pen, but the shape of the caudal fin is different, and the arms are more nearly equal in length. The arms are also represented as having small swellings at the tips. Its tentacular arms are not known.

Brachioteuthis Beanii Verrill.

Trans. Conn. Acad., v, p. 406, pl. 55, figs. 3–3*b*; pl. 56, figs. 2, 2*a*, Nov., 1881.

Plate XLV, figs. 3–3*b*. Plate XLVI, figs. 2, 2*a*.

Male: Body rather small, tapering backward to an acute posterior end; dorsal mantle-edge with a broad obtuse angle; caudal fin large in proportion to the body, broad rhomboidal; outer angles prominent, anterior to the middle; the anterior lobes project forward considerably beyond the insertions, and are rounded. The form of the fin is much like that of *Ommastrephes*. Head thickened at the bases of the arms, not so large in proportion to the body as in *C. lacertosa*. Eyes large, eye-lids thin. Siphon large, with two strong dorsal bridles; internal valve broad, rounded, somewhat back from the orifice; connective cartillages long-ovate, broadest behind (fig. 2*a*); dorsal cartilage of neck oblong, with a strong median ridge and two deep parallel grooves. Lateral cartilages of mantle (fig. 2) are simple linear ridges, extending to the edge of the mantle. Arms not very large, somewhat rounded, long and slender; the dorsal ones are much smaller and shorter than the others; two lateral pairs nearly equal in size and length, more than two-thirds the length of the mantle. Ventral arms shorter and much more slender than the lateral, more than half the length of the mantle; the ventral arms show but little of the compressed, oblique form, so conspicuous in the preceding species, and the crest or fold of skin along the outer-ventral angle is narrow, thin, and not very conspicuous; the suckers on the ventral arms are in two alternating, not distant rows, often appearing almost as if in one row toward the base, where they become smaller, but are of the normal cup-shaped form, with finely denticulate rings and slender pedicels; the tips of both ventral arms are much injured, but small, normal, long pedicled suckers can be traced to the tip of the left arm; the right arm is denuded of its skin and suckers at the tip. The suckers of the four lateral arms are in two rather close rows, larger, oblique, low cup-shaped, attached by slender pedicels, which are somewhat swollen just below the suckers; most of them have lost their horny rings; marginal membranes rudimentary. Web between the arms rudimentary.

Tentacular arms very long and slender, in alcohol about twice the length of the mantle; a few scattered sessile suckers are found along the whole length of the arms; tentacular club well-developed, long-ovate, oblique, with a thick wrist and flat or concave sucker-bearing face; suckers small and very numerous, crowdedly arranged in many rows (probably sixteen rows or more), some of the middle ones larger than the rest; suckers not well preserved, but all appear to have been alike in form; pedicels long and slender, with a smooth and not very large swelling below the base of the sucker; the suckers have lost their horny rims, but the sheaths are shaped much like those of *C. lacertosa*, the distal portion being hood-shaped, with a lateral opening, while the basal part is swollen laterally. The tip of the club is simple, without

any such spoon-shaped appendage as is found in the preceding species. Buccal membrane large, with a free thin edge which scarcely forms angles.

Pen (fig. 3*a*) with a narrow, linear anterior portion, consisting of more than half its length, decreasing in width backward, then suddenly expanding into the posterior portion, which is broad and thin, and infolded, so as to form a large, compressed posterior cavity; the anterior portion is concave beneath, with no mid-rib, the edges ex-curved and slightly thickened; when spread out and flattened the posterior portion has a lanceolate form, rather abruptly widening anteriorly and very gradually tapering backward, with a double midrib, and some delicate lines parallel to it, while the lateral expansions are very thin and delicate.

The teeth on the odontophore (Plate XLV, fig. 3*b*) form seven rows: the median ones have a large, acute, central, and two small lateral denticles; the inner lateral teeth have a large, acute inner denticle, and a very small outer one; the next to the outer teeth are somewhat stouter than the outermost, which are very acute and strongly curved; no marginal plates were observed.

Color of body mostly destroyed, in the typical specimens, but small, light purplish brown chromatophores are uniformly scattered over the parts best preserved; this is also the case on the head, siphon, and outer surfaces of the arms, where the skin is well preserved; scattered spots also occur on the inner surfaces, between the suckers.

The male described above has the mantle 62^{mm} long; length of caudal fin, 31; its breadth, 36; end of tail to base of arms, 85; length of dorsal arms, 26; of second pair, 48; of third pair, 45 + (tips gone); of fourth pair, 35; of tentacular arms, 118; of sucker-bearing portion of club, 16; breadth of tentacular arms, 2; of club, 4; of lateral arms, at base, 3.5; of ventral arms, 3; diameter of eye-ball, 8; of largest suckers of lateral arms, 1.2; length of pen, 62; of anterior, narrow portion, 38; its breadth anteriorly, where widest, 2; where narrowest, 1.25; length of posterior portion, 24; its breadth, 8^{mm}.

The supposed female has lost the tail, but the arms are in better condition than those of the male; it differs from the male in having distinctly smaller suckers on the lateral arms. Length of dorsal arms, 27^{mm}; of second pair, 44; of third pair, 46; of fourth pair, 37; of tentacular arms, 120; of club, 16^{mm}.

A larger specimen (station 994), which has lost its head and pen and therefore cannot be positively identified, has a much darker color. It is dark purplish brown over the whole body.

Two typical specimens were obtained off Martha's Vineyard, at stations 1031 and 1033, in 255 and 183 fathoms; one, of doubtful identity, at station 994, in 368 fathoms, by the U. S. Fish Commission, in 1881. All three were from fish-stomachs.

This interesting species was named in honor of Dr. T. H. Bean, the ichthyologist, who took charge of the fishes on the "Fish Hawk" this season.

Histioteuthis Collinsii Verrill. (See p. [121].)

Plate XXIII. Plate XXIV, figs. 3–7. Plate XXV, figs. 1, 1*a*. Plate XLV, figs. 6, 6*a*.

The teeth of the odontophore originally described and figured (p. [123], Plate XXIV, fig. 6) were not the most developed of those on the same odontophore; therefore, I have prepared another figure (Plate XXIV, fig. 7). The pedicels of the larger suckers on the tentacular club are very peculiar. They are, when extended, long and remarkably stout, their diameter being more than half that of the sucker. They are cylindrical, and are capable of being invaginated to near the middle, so that they can be lengthened out or very much shortened by a sort of telescopic motion. The upper end is thick, and so fits the basal part of the broad sucker that it acts as a piston, very perfectly. (Plate XXXV, figs. 1, 1*a*.)

Two additional examples of this interesting species have been received. The first is in nearly the same condition as, but is considerably smaller than, the one originally described. The head and arms alone remain, but these are well enough preserved to show the characteristic color-marks. It was taken from a cod, on the western part of the Grand Bank, N. F., by Captain Johnson and crew, of the schooner "Augusta Johnson" (lot 962). Presented to the U. S. Fish Commission, June, 1881.

The last example also consists only of the head and sessile arms, and is not in so good condition as either of the others referred to. It is about as large as the one originally described. This was taken by Capt. Chas. Anderson and crew, of the schooner "Alice G. Wonson," in 180 fathoms, near the northeast part of George's Bank, October, 1881.

Desmoteuthis tenera Verrill.

Trans. Conn. Acad., v, p. 412, pl. 55, figs. 2–2*d*, pl. 56, fig. 3.

Plate XLV, figs. 2–2*d*. Plate XLVI, fig. 3.

Two small but perfect specimens of this new species were taken in the "trawl-wings"* this season, at station 952, in 388 fathoms.

The specimens are both males, but show no positive evidence of hectocotylization. The eyes are very large and prominent, occupying the whole of the sides of the head, wide apart dorsally, but nearly in con-

*The "trawl-wings," which were first invented and used by the U. S. Fish Commission, this summer, consist of fine nets attached to a support extending out from each end of the trawl-beam. When in use they are about two feet above the sea bottom. They are provided with an interior funnel-shaped net to prevent the escape of animals captured. They have been of great value to us for capturing, and retaining in excellent condition, many kinds of free-swimming deep-sea animals, not otherwise obtainable, or if taken in the trawl crushed by the great masses of fishes, echinoderms, actiniæ, etc., usually taken in every haul in those waters.

Among the things captured in the "trawl-wings" are not only several cephalopods (including *Alloposus*, *Lestoteuthis*, *Rossia*), but *Cymbulia calceolus*, and other Pteropods; vast numbers of *Sagitta*, one of them bright orange-colored; numerous species of Copepod crustacea, some of them of great size; Schizopods; Salpæ; Acalephs, including one very remarkable new form of Siphonophora, etc.

tact beneath; eye-lids thin, entire. The body is long, somewhat fusiform, slightly smaller in advance of the middle. The tissues are exceedingly thin, delicate, pale, and translucent, so that the pen and other organs can be seen through the mantle. Anteriorly the edge of the mantle is directly attached to the head, medially, by a muscular commissure, and there is *no free edge* (such as D'Orbigny figures in *Taonius pavo*) at the narrow middle portion of this band. This commissure is broader within the mantle, and there is another large, oblique, muscular commissure, extending forward to the edge of the mantle, on each side, extensively uniting the inner surface of the mantle to the sides of the siphon. These commissures leave only a rather narrow opening to the gill-cavity, on each side, and one small ventral one, and the interior ventral cavity is partitioned off from the lateral ones.

The siphon is large, projecting forward between the lower sides of the large eyes; it has no valve in the ordinary place, but toward the base, on the dorsal side, there are two erect, rounded, ear-like flaps, each accompanied by a prominent papilla (i'), and farther forward a raised, median, transverse fold, and a central papilla (i). (Plate XLV, fig. 2*d*.)

The caudal fin is comparatively small, narrow-ovate, tapering to a short, blunt posterior end, and with the anterior lobes narrowed and scarcely projecting beyond the insertions.

Arms rounded, rather slender, tapering to slender tips; those of the third pair are much the longest, and like the second pair, bear along the distal half suckers much larger than the proximal ones; tips short, with few small suckers. The dorsal and ventral arms are about equal, and not much more than half as long as the third pair; they bear smaller suckers, in two rows, regularly decreasing distally. The second pair is intermediate in length between the first and third pairs, with two rows of larger suckers on the outer half, suddenly decreasing distally, with minute ones close to the tip. The large suckers (fig. 2*b*, 2*c*) on the second and third pairs of arms are much larger than the others, but similar in form, deep cup-shaped, convex in the middle, obliquely attached, with a smooth horny rim, except on the distal ones, which have blunt denticles externally. There are about sixteen of these suckers on each of the lateral arms, but eight or ten are decidedly larger than the rest. The large suckers commence nearly at the middle of the arms and extend to very near the tips. The third pair of arms have a thin median carina on the outer side, along the distal third. All the arms have a wide marginal or protective membrane along the inner edges, outside the suckers; these membranes are strengthened by transverse thickened, muscular processes, opposite each sucker; between these the membrane recedes so that the edge is scolloped. The ventral arms have also a membrane along the outer, ventral angle. I am unable to detect any positive signs of hectocotylization, either in the dorsal or ventral arms. Perhaps the presence of the very large suckers on the lateral arms may be a sexual character, but if so, they are symmetrical on the two sides.

Tentacular arms (Pl. XLVI, fig. 3), rather stout, tapering from the thickened base, and in our specimens, equalling in size, and not much longer than, those of the third pair; club well developed, rather broader than the rest of the arm, with a dorsal keel and wide, marginal, protective membranes; the suckers are arranged in four regular rows; the larger suckers are about equal in size to the larger ones of the dorsal arms; of these there are eight or nine in each row, the marginal ones are scarcely smaller than the median ones and similar in shape, but more oblique, all there suckers are cup-shaped, obliquely attached, with long pedicels; the marginal ring is denticulated all around, the teeth on the outer or higher side being slender, sharp, and incurved; those on the inner side minute. The distal part of the club is short, and covered with four rows of small suckers, similar to the larger ones in shape and armature; at the tip is a small group of minute suckers, apparently unarmed. At the proximal end of the club there is a group of small denticulated suckers, and four irregular rows of minute, connective suckers, attached by short pedicels, extend along the inner surface of the arm to the middle or beyond; these are interspersed with minute tubercles, more distinct distally, near the club. The outer buccal membrane is narrow, without distinct angles.

The pen is very thin, pale yellow; the anterior portion is narrow and slender; the posterior portion, commencing opposite the origin of the fins, is lanceolate, with two faint, close ribs along the middle, and less distinct parallel lines each side of these; the tip is a hollow cone, about 10^{mm} long.

The teeth of the odontophore (Pl. XLV, fig. 2 *a*) form seven rows; the median teeth have a very large and long median denticle, and a small lateral one on each angle; the inner lateral teeth have a large inner and a very small outer denticle; the two outer rows of teeth are rather stout; a marginal row of rather ill-defined elliptical plates on each side.

Color of mantle pale yellowish white, with scattered, conspicuous, round, or more or less elliptical, purplish-brown spots, 2 to 3^{mm} in diameter, and 5 to 10^{mm} apart. Eyes dark purplish or chocolate-brown; head, siphon, and outer surfaces of arms thickly specked with purplish brown chromatophores.

The length of the largest specimen is 163^{mm}, from end of tail to tip of third pair of arms; length of mantle dorsally, 116^{mm}; mantle to base of dorsal arms, 11^{mm}; diameter of eyes, 17^{mm}; breadth of head across eyes, 30^{mm}; breadth of body, 26^{mm}; length of caudal fin, 45^{mm}; its breadth, 28^{mm}; length of dorsal arms, 20^{mm}; of second pair, 25^{mm}; of third pair, 32^{mm}; of fourth pair, 20^{mm}; of tentacular arms, 35^{mm}; of club, 11^{mm}; breadth of lateral arms, at base, 3.5^{mm}; diameter of largest suckers, 2.5^{mm}.

Off Martha's Vineyard, 87½ miles from Gay Head, station 952, in 388 fathoms. U. S. Fish Commsssion, Aug. 4, 1881.

Notes on the visceral anatomy.

Anatomically, this species closely resembles *Desmoteuthis hyperborea*. (See Plate XXV, fig. 1.) It has a similar short, thick, compressed, ovate liver, with the intestine in a groove along its ventral edge, and the small ink-sac imbedded in its antero-ventral surface. The gills are laterally placed, short, with long lamellæ. The heart is small, irregularly tubular, oblique, with four angles or lobes where joined by the principal vessels. The efferent vessels from the gills are long and conspicuous, because the bases of the gills are distant from the heart.

The alimentary tract consists of a short, narrow rectum, attached to the liver, and ending in a bilabiate aperture, guarded by two slender papillæ; of a long, rather wide, tubular portion, extending back to the base of the caudal fin, and covered, along the ventral side, with lateral rows of clusters of small follicular glands, which, near the liver, diverge into two, separate, large, lateral clusters; posteriorly, where the rows of follicles cease, there is a small, firm, bean-shaped glandular organ, lamellose within, probably serving as a gizzard; this is followed by a long tubular, or fusiform, more or less saccular stomach and a cæcal appendage, running back nearly to the end of the body; at its anterior origin this cæcal appendage is separated from the stomach by a constriction.

The testicle is a rather small, slender, lanceolate organ, attached laterally, for its whole length, to the side of the cæcal appendage. The prostate gland and vesiculæ seminales have their usual position at the base of the left gill, but they are small and probably not fully developed; the efferent duct extends over and a short distance beyond the base of the gill, and is slender and pointed. The renal organs are very different from those of the common squids (*Loligo* and *Ommastrephes*). The posterior part of the anterior vena-cava becomes glandular in front of the heart; there it parts, sending a long, smooth vein to the base of each gill; there each of these veins expands into an ovate renal organ, before joining the branchial auricles.

Architeuthis Harveyi Verrill. (No. 27; see p. [201].)

Since the preceding pages were put in type, I have been able to examine the specimen* mentioned on p. [201].

This specimen was purchased by Mr. E. M. Worth, and preserved, in alcohol, at his museum, 101 Bowery street, New York, where I had a good opportunity to examine it, about two weeks after it had been put in alcohol.

Although this is more nearly complete than any specimen hitherto brought to this country, the arms and suckers are not so well preserved

* An account of this specimen, accompanied by a wood-cut, apparently copied from the photograph, was published in "Harper's Weekly" for December 10. This figure, though poor, gives a fair idea of the general appearance of the creature as it would look if lying flabby and collapsed on the shore. The peculiar appearance of the caudal fin was due to mutilation of that organ.

as in some of the other examples. All the sessile arms have lost more or less of their tips, so that the actual length cannot be given, and many of their suckers are either injured or lost; the tentacular arms are also injured and most of the large suckers of the clubs are destroyed; the caudal fin was not only torn by handling, but one-half of it had, apparently, been destroyed and the wound healed before the death of the creature,* so that its true form cannot be determined; the eye-balls were burst, and most of the pen was gone.

The head, eye-lids, siphon, and front edge of the mantle are, however, in fair condition, and as these parts have not been well preserved in any of the previous examples, some new and valuable facts were learned in regard to the structure of these organs.

Many of the following characters are of generic value: The eye-lids were large, not much thickened, and only slightly angulated, and with a shallow sinus; diameter of opening about 120^{mm} (4.5 to 5 inches). The transverse nuchal crests, behind the eyes, are distinct, but only slightly elevated; of the longitudinal ones, only one, on each side, is distinct, but it is short and not very high; the others (unless they had been rubbed off) are rudimentary. The siphon is large and broad; aperture, 102^{mm} (4 inches) broad, slightly bilabiate, with a broad valve within; dorsal bridles moderately developed. Siphon-pit shallow, *smooth*. Connective cartilages, on base of the siphon, simple, long-ovate, slightly oblique, and only a little concave. Connective cartilages on the sides of the mantle short, and close to the front edge, very simple, consisting of a short, slightly raised, longitudinal ridge. The dorsal angle of the mantle-edge projects forward considerably beyond the sides, as an obtuse angle; the lateral angles are also distinct. The body is large and broad in the middle and anteriorly, but tapers very rapidly to the base of the caudal fin, which is relatively small.

This specimen, when examined by me, measured as follows: Length of mantle, to the lateral angles of the front edge, 4.16 feet; from edge of mantle to inner base of ventral arms, 1.25 feet; circumference of body, 4 feet; length of caudal fin, tip to anterior end of lobe, 21 inches; breadth of one-half of fin, median line of tail to outer edge, 8 inches; length of tentacular arms, 15 feet; of club, 2 feet; from first of the large median suckers to the tip, 20 inches; length of ventral arms (minus tips), 4.66 feet; their circumference at base, 8.5 inches; length of the dorsal arms (minus tips), 4.5 feet; their circumference, 7.5 inches; circumference of second pair of arms, 7.5 inches; of third pair, 8.5 inches; diameter of largest suckers of sessile arms, .75 of an inch.

The arms have a stout appearance, especially toward the base, and do not differ very much in size. In the form of the arms and in the structure of the suckers this specimen agrees essentially with those that

* Owing to this fact, which was not understood by those who saw and figured it at first, some of the cuts that have been printed give the tail very peculiar and remarkable forms.

I have already described. The mandibles are nearly black; their anterior alar edges have a deep notch and a prominent tooth.

The color, which is partially preserved on the arms and ventral side of the body, agrees very well with that of *Ommastrephes illecebrosus*. The skin is bluish or pinkish, thickly specked with small purplish brown chromatophores.

Architeuthis princeps? V. (No. 28.)

In a letter from the Rev. M. Harvey, dated December 19, 1881, he informs me that he had been told by Mr. C. D. Chambers, magistrate of Harbour Buffet, Placentia Bay, N. F., that a very large specimen of *Architeuthis* had been found on the beach at Hennesey's Cove, Long Island, Placentia Bay, during the first week of November last. This was discovered by Albert Butcher and George Wareham, who cut a portion from the head. The specimen had been much mutilated by crows and other birds. The locality is uninhabited. The men estimated the length of the body and head at 26 feet, but this is probably too large an estimate.

Conspectus of the families, genera, and species of Cephalopoda included in this paper.

In the following synopsis the species that have actually been proved to belong to the fauna of the northeastern coast of America, or the waters adjacent, are numbered serially. They have all been personally studied by me, except *Taonius pavo*.

Subclass DIBRANCHIATA. (See p. [73].)

Order I.—DECACERA Blainville. (See p. [75].)

OIGOPSIDÆ. (See p. [75].)

The division called *Oigopsidæ* includes two very diverse groups, differing very widely in their visceral anatomy, as well as in the structure of the eyes, siphon, and mantle connections. These may be called *Teuthidea* and *Taonidea*.

The former will include all the Oigopsidæ described in this paper except the *Desmoteuthidæ*. The *Taonidea* will include the *Desmoteuthidæ* and also several allied forms, which have usually been carelessly referred to *Loligopsis*.

TEUTHIDEA Verrill.

Eyes with free lids, not stalked. Siphon with a subterminal valve. Mantle attached to the siphon by free connective cartilages. Stomach large, pouch-like; intestine short; liver very large; ink-sac large. Pen

horny, well developed, as long as the mantle. One of the ventral arms is usually hectocotylized in the male. Arms with suckers, or with claws, or with both.

FAMILY TEUTHIDÆ Owen (restricted). (See pp. [69], [75].)

For a brief synopsis of the previously known genera of this family, see pp. [69–70].

ENOPLOTEUTHIS. (See pp. [70], [203].)

Enoploteuthis Hartingii Verrill. (Pp. [53], [203].)
Enoploteuthis Cookii Owen = *E. Molinæ* D'Orb. (Pp. [53], [203].)

MOROTEUTHIS Verrill. (See pp. [70], [209].)

Moroteuthis robusta (Dall) Verrill. (Pp. [65], [209].)

GONATUS Gray. (See pp. [204], [206].)

Gonatus amœnus Gray. (Pp. [204], [206].)

LESTOTEUTHIS Verrill (See pp. [70], [76], [78], [204], [205].)

1. **Lestoteuthis** Fabricii (Licht.) Verrill. (Pp. [76], [79], [206].)

FAMILY OMMASTREPHIDÆ. (See pp. [80], [201].)

OMMASTREPHES. (See pp. [81–83], [202].)

Ommastrephes (*pars*) D'Orbigny, Voy. Am. Mérid., 1835; Céphal. Acétab., p. 341. *Illex* and *Todarodes* Steenstrup, Oversigt k. Danske Vidensk. Selsk. Forhand., 1880, p. 90.

2. **Ommastrephes illecebrosus** (Les.) Verrill. (Pp. [83], [202].)

STHENOTEUTHIS Verrill. (See pp. [99], [201].)

3. **Sthenoteuthis megaptera** Verrill. (P. [100].)
Sthenoteuthis pteropus (Steenst.) Verrill. (Pp. [103], [107], [202].)
4. **Sthenoteuthis Bartramii** (Les.) Verrill. (P. [112].)

ARCHITEUTHIS (Steenst.) Harting, 1881. (See pp. [1–20], [23], [51–65], [114], [199].)

Architeuthus Steenst., 1856 (no description).
5. **Architeuthis Harveyi** Verrill. (Pp. [23–40], [114], [200–201], [219].)
6. **Architeuthis princeps** Verrill. (Pp. [41–50], [114].)
Architeuthis monachus (Steenst.). (Pp. [24], [51–62].)
Architeuthis dux (Steenst.) Gervais. (Pp. [24], [51], [200].)
Architeuthis Hartingii Verrill. (Pp. [53], [200].)
Architeuthis Bouyeri Verrill. (Pp. [54–57].)
Architeuthis (?) Mouchezi Velain. (Pp. [63–65].)
Architeuthis grandis (Owen) Verrill. (Pp. [57–59], [200].)

The number of the foreign species, mostly nominal and imperfectly known, will undoubtedly be much reduced when they become better known. Probably *A. dux* and *A. Bouyeri* are identical, but there is as yet no proper zoological description of either. The former has been very briefly described by Gervais, and Harting has published an outline figure of one of the mandibles.

FAMILY MASTIGOTEUTHIDÆ Verrill. (See p. [114].)

MASTIGOTEUTHIS Verrill. (See p. [115].)

7. **Mastigoteuthis Agassizii** Verrill. (P. [115].)

FAMILY CHIROTEUTHIDÆ Gray (restricted). (See p. [118].)

CHIROTEUTHIS D'Orb. (See p. [118].)

Chiroteuthis is the only genus in this family that has been hitherto recognized.

8. **Chiroteuthis lacertosa** Verrill. (Pp. [119], [209].)

BRACHIOTEUTHIS Verrill. (See p. [213].)

9. **Brachioteuthis Beanii** Verrill. (P. [214].)

CALLITEUTHIS Verrill. (P. [117].)

10. **Calliteuthis reversa** Verrill. (P. [117].)
Calliteuthis ocellata (Owen) Verrill. (P. [202].)

FAMILY HISTIOTEUTHIDÆ Verrill. (See p. [120].)

HISTIOTEUTHIS D'Orbigny. (See p. [120].)

11. **Histioteuthis Collinsii** Verrill. (Pp. [121, 216].)

TAONIDEA Verrill.

Eyes large, stalked or prominent, having free lids, but no sinus. Mantle united to base of siphon and back of neck by three muscular commissures. Siphon large, without a true subterminal valve, but usually with special elevated processes, or flaps, in the basal portion. Stomach small, far back; intestine very long, covered with lateral follicular glands; liver small, far forward; ink-sac small. Pen slender anteriorly, as long as the mantle. Hectocotylized arm not observed. All the arms bear suckers.

FAMILY DESMOTEUTHIDÆ Verrill. (See p. [124].)

Body much elongated, mantle united to the neck by three muscular commissures. Siphon without a true valve, but with three peculiar, special thickenings, or raised processes,* in its basal portion. Eyes prominent. Intestine very long; ink-sac small.

DESMOTEUTHIS Verrill. (See p. [125].)

12. **Desmoteuthis hyperborea** (Steenst.) Verrill. (P. [126].)
13. **Desmoteuthis tenera** Verrill. (P. [216].)

TAONIUS Steenstrup (restricted). (See p. [129].)

14. **Taonius pavo** (Les.) Steenstrup. (See p. [130].)

MYOPSIDÆ D'Orbigny. (See p. [131].)

This artificial division includes two very diverse groups, which not

* Of these organs the median dorsal one is larger and more complicated than the others (see Pl. LV, fig. 2*d*, *m*; and fig. 4*a*). It seems to me probable that this organ is the true homologue of the foot of gastropods.

only differ widely in the condition of the eyes, but also in the nature of the hectocotylization of the arms, and in anatomical characters.

To one of these groups, containing the family *Sepiolidæ*, I propose to apply the name *Sepiolidea*.

The other division, *Sepidea*, includes the families *Sepidæ*, *Loliginidæ*, *Idiosepidæ*, and perhaps *Spirulidæ;* but the latter might, perhaps, be best placed with several fossil forms in a division of which it is the sole surviving genus.

SEPIDEA Verrill.

The integument extends entirely over the eye, and there is a pore in front of it. Pupil crescent-shaped. Body commonly elongated. Pen various, rarely absent, usually large, broad-lanceolate or ovate, either horny or calcareous (spirally coiled, tubular, and chambered in *Spirula*, in which it is posteriorly situated). One of the ventral arms of the male is usually hectocotylized.

Mantle usually with three connective cartilages, rarely with one (dorsal) or three muscular commissures.

Family LOLIGINIDÆ. (See p. [131].)

Loligo Lamarck. (See p. [131].)

15. Loligo Pealei Les. (P. [132].)
16. Loligo (Lolliguncula) brevis Blainv. (P. [161].)

Sepioteuthis D'Orbig. (See p. [163].)

Sepioteuthis sepioidea D'Orb. (See p. [164].)

SEPIOLIDEA Verrill.

In this group the eye-lids may either be entirely free all around, or the upper one may be attached to the eye-ball. Pupil either round or crescent-shaped. Body short, obtuse. Fins lateral, separated. Pen small or rudimentary, sometimes absent. Sucker-rings smooth. Dorsal arms, in the male, usually hectocotylized, one or both.

Family SEPIOLIDÆ. (See p. [165].)

Stoloteuthis Verrill. (See p. [165].)

17. Stoloteuthis leucoptera Verrill. (P. [165].)

Rossia. (See p. [167].)

18. Rossia megaptera V. (P. [173].)
19. Rossia Hyatti V. (P. [167].)
20. Rossia sublevis V. (P. [170].)

Heteroteuthis Gray. (See p. [174].)

21. Heteroteuthis tenera V. (P. [175].)

Order II.—OCTOPODA Leach. (See p. [177].)

Family PHILONEXIDÆ D'Orb. (See p. [178].)

Parasira Steenst. (See p. [178].)

Vidensk. Meddel. Naturh. Forening, Kjöbenhavn, 1860, p. 333.

22. **Parasira catenulata** Steenst. (P. [179].)

Family ARGONAUTIDÆ Cantr. (See p. [182].)

Argonauta Linné.

23. **Argonauta argo** Linné. (P. [182].)

Family ALLOPOSIDÆ Verrill. (See p. [180].)

Alloposus Verrill. See p. [180].)

24. **Alloposus mollis** Verrill. (P. [181].)

Family OCTOPODIDÆ D'Orb. (See p. [183].)

Octopus Lam. (See p. [185].)

25. **Octopus Bairdii** Verrill. (P. [185].)
26. **Octopus lentus** Verrill. (P. [191].)
27. **Octopus piscatorum** Verrill. (P. [194].)
28. **Octopus obesus** Verrill. (P. [193].)

Octopus rugosus Bosc. (P. [195].)
Octopus vulgaris Lam. (P. [72].)
Octopus punctatus Gabb. (P. [72].)

Eledone Leach. (P. [183].)

29. **Eledone verrucosa** Verrill. (P. [183].)

Family CIRRHOTEUTHIDÆ Keff. (See p. [196].)

Stauroteuthis Verrill. (P. [196].)

30. **Stauroteuthis syrtensis** Verrill. (P. [196].)

EXPLANATION OF THE PLATES.

All the figures were drawn from nature by Mr. J. H. Emerton, except when otherwise stated.

Plate I.

Figure 1.—*Architeuthis Harveyi* (No. 5). Head and arms; $\frac{1}{3}$ natural size. From a photograph of the specimen when freshly caught. The back of the head rests upon an oar, so as to cause the beak to protrude, while the arms hang down in a reversed position. The diameter of the bathing tub was 38.5 inches: *a*, left, and *a'*, right ventral arms; *b*, left, and *b'*, right arms of the third pair; *c*, left, and *c'*, right arms of the second pair; *d'*, right dorsal arm, mostly concealed behind the others; *e*, left, and *e'*, right tentacular-arms, folded several times over the oar; *i* to *iv*, the 'club'; *i* to *ii*, the 'wrist'; *ii* to *iii*, the part bearing large suckers; *iii* to *iv*, the terminal division; *o*, the beak.

Figure 2.—Part of the body and caudal fin of the same specimen; $\frac{1}{3}$ natural size. From a photograph made at the same time with the preceding; *u*, mantle cut open; *t*, tip of tail; *b*, right, and *l*, left lateral lobes of the caudal fin.

Plate II.

Figure 1.—*Architeuthis Harveyi*.—A restoration, $\frac{1}{12}$ natural size, based on the preceding figures and on the specimens received. (See note, p. 9.)

Plate III.

Figure 1.—*Architeuthis Harveyi* (No. 5). Upper mandible; natural size.

Figure 2.—Lower mandible of same; natural size; lacks a small piece at *a*.

Figure 3.—Posterior part of the 'pen' of the same specimen; $\frac{1}{8}$ natural size. The dotted lines indicate missing parts.

Figures 4, 4*a*.—*Architeuthis Harveyi*. (Specimen No. 4.) The two sides of the broken lower mandibles; natural size.

Figures 1 and 2 were drawn by Mr. J. H. Blake, from the alcoholic specimens; figure 3 was restored and drawn by the author; figures 4 and 4*a* are camera-drawings by the author.

Plate IV.

Figure 1.—*Architeuthis Harveyi* (No. 4). One of the larger suckers from the tentacular arms; natural size. From a dried specimen.

Figure 1*a*.—Portion of the marginal ring of the same sucker, seen from the inside; enlarged.

Figure 2.—The same. (No. 24.) Distal part of arm. Front view; natural size.

Figure 2*a*.—The same. Front view. 50th sucker of 2nd pair of arms; enlarged 12 diameters. The marginal scales are destroyed on one side.

Figure 3, 3*a*.—*Architeuthis Harveyi* V. (No. 2). Horny ring of one of the marginal suckers of the club; 3, side view; 3*a*, the same, front view; enlarged 3 diameters.

Figure 4.—*Architeuthis Harveyi* (No. 5). Suckers of tentacular-club; side view, natural size; *a*, one of the larger suckers; *b*, one of the marginal suckers.

Figure 5.—The same specimen. Horny marginal ring of one of the suckers from near the base of ventral arm; enlarged 2 diameters.

Figures 6 and 6*a*.—The same specimen. One of the largest and least oblique of the horny rings from a sucker near the base of one of the lateral arms; top and side views; enlarged $1\frac{1}{2}$ diameters.

Figures 7 and 7*a*.—The same specimen. One of the rings from a medium-sized and more oblique sucker of the middle portion of the lateral arms; top and side views; enlarged 1½ diameters.

Figure 8.—The same specimen. Another ring from a more distal, smaller, and more oblique sucker, top view; enlarged 1½ diameters.

Figures 9 and 9*a*.—The same specimen. One of the horny rings from one of the smooth-rimmed, sessile, connective suckers on the 'wrist' of the 'club' of the tentacular arms; top and side views; enlarged 3 diameters.

Figures 10 and 10*a*.—The same specimen. One of the small suckers from the distal portion of the 'club', top and side views; enlarged 3 diameters.

Figure 11.—The same specimen. Caudal fin; $\frac{1}{10}$ natural size; drawn from the preserved specimen.

Figures 4, 5 and 11 were drawn by the author, also figure 8, which is a camera-drawing. The others are by J. H. Emerton.

Plate V.

Figure 1.—*Architeuthis Harveyi* V. (No. 5). Teeth of the odontophore, from the anterior portion; enlarged 18 diameters; *a*, median; *b*, inner lateral; *c* and *d*, the two outer lateral teeth; *e*, marginal plates. Drawn from detached teeth.

Figure 2.—The same specimen. Teeth from farther back, on the dorsal portion of the odontophore. Lettering as in fig. 1.

Figure 3.—The same specimen. Anterior portion of odontophore, showing the teeth nearly in their natural positions; enlarged about 3 diameters.

Figure 4.—The same specimen. Portion of the membrane lining the palate, showing the teeth, and hard granules attached to it: enlarged.

Figure 4*a*.—The same specimen. Two of the granules from the membrane lining the mouth; enlarged 18 diameters.

Figure 5.—The same specimen. Another portion of the lining membrane of the palate; enlarged.

Figure 6.—*Architeuthis Harveyi* V. (No. 24). Teeth of odontophore; *a*, median; *b*, inner-lateral; *c*, *c'*, and *d*, from two outer lateral rows; enlarged about 24 diameters. Drawn from detached teeth.

Figure 7.—The same specimen. Portion of radula, showing most of three transverse rows of teeth; enlarged 18 diameters.

Figure 8.—The same specimen. Otolith; *a*, side view; *b*, front view; much enlarged. All the figures are camera-drawings by the author.

Plate VI.

Figure 1.—*Architeuthis Harveyi* V. (No. 24). Young. Pharynx and beak, with odontophore; *o*, œsophagus; natural size.

Figure 2.—The same. Distal part of tentacular-arm, with club; natural size.

Figures 3 and 3*a*.—The same. Segment from distal portion of left arm of the third pair of sessile arms, front view; 3*a*, the same, side view; natural size.

Figure 4.—The same. Basal portion of right arm, of second pair. Front view; natural size.

Plate VII.

Figure 1.—*Architeuthis princeps* V. Side view. Restored mostly from No. 13; $\frac{1}{36}$ natural size.

Figure 2.—*Sthenoteuthis pteropus* V. Side view of the specimen from Bermuda; $\frac{1}{6}$ natural size.

Figure 2*a*.—Caudal fin of the same specimen. Dorsal view; $\frac{1}{6}$ natural size.

PLATE VIII.

Architeuthis princeps V. (No. 14). General figure; from the recently preserved specimen; restored in accordance with the measurements of the freshly caught specimen; $\frac{1}{32}$ natural size. Drawn by the author.

PLATE IX.

Figures 1 and 1*a*.—*Architeuthis princeps* Verrill (No. 14). A marginal ring from one of the large suckers of the tentacular-arm; 1, side view, enlarged 1½ diameters; 1*a*, portion of the rim; enlarged 3 diameters.

Figures 2 and 2*a*.—The same specimen. One of the medium-sized, oblique rings of a sucker from the distal part of a sessile arm; enlarged 1½ diameters; top and side views.

Figures 3 and 4.—The same. Top and side views of one of the smaller and more distal rings, from a sessile arm; enlarged 3 diameters.

Figures 5 and 6.—The same. Top and side views of a complete sucker, with its pedicel, from the middle of a sessile arm; enlarged 1½ diameters.

Figure 7.—The same. Top view of one of the smaller, very oblique, distal sucker-rings, from a sessile arm; enlarged 3 diameters.

Figure 8.—The same. Portion of the horny ring of a medium-sized sucker from the middle of a sessile arm; top view; enlarged 6 diameters; from a camera-drawing.

Figure 9.—The same. Side view of the horny ring of one of the largest and least oblique of the suckers from near the base of the lateral arms; enlarged 1½ diameters.

Figure 10.—The same. Side view of the horny ring of one of the marginal suckers of the tentacular-club; enlarged 3 diameters.

Figure 11.—*Architeuthis princeps* (No. 13). Portions of the horny ring of one of the large suckers of the tentacular-arm, much enlarged; *a* and *b*, portions of the margin, from the outside; *c*, portion seen from the inside.

Figures 8 and 11 are camera-drawings by the author; all the others are by J. H. Emerton.

PLATE X.

Figure 1.—*Architeuthis princeps* V. (No. 14). Caudal fin from beneath; from the specimen a few days after it had been placed in alcohol; about $\frac{1}{6}$ natural size.

Figure 2.—The same specimen. After it had been preserved several months in strong alcohol; about $\frac{1}{6}$ natural size.

Figure 1 was drawn by J. B. Holder, M. D.; figure 2 by the author.

PLATE XI.

Figure 1.—*Architeuthis princeps* V. (No. 10). Upper jaw; natural size.

Figure 2.—The same. Lower jaw; the dotted line shows the parts that are present on the opposite side.

Figure 3.—*Architeuthis princeps* (No. 1). Part of lower jaw; side view; natural size.

Figure 3*a*.—The same. Front view; natural size. The rest of this beak had been destroyed.

Figures 1 and 2 were drawn by the author; figure 3 by J. H. Emerton.

PLATE XII.

Figure 1.—*Architeuthis Hartingii* V. Lower mandible, showing the anterior portion only; natural size.

Figure 1*a*.—The same. Section of a sucker from a sessile arm of the same specimen; 1*b*, horny ring of the same; natural size. After Harting.

Figure 1*c*.—The same. Teeth on the radula. After Harting.

Figure 2.—*Architeuthis dux* Steenstrup. Lower mandible; natural size. Copied from Harting's figure, after Steenstrup.

Figure 3.—*Architeuthis monachus* Steenstrup (Type specimen). Lower mandible; natural size. After Steenstrup.

Figure 4.—*Enoploteuthis Hartingii* Verrill. Anterior portion of jaws; natural size. After Harting.

Figure 5.—*Moroteuthis robusta* Verrill. Section of the solid, terminal cone of the pen; natural size.

Plate XIII.

Figure 1.—*Moroteuthis robusta* (Dall) V. Side view of one of the specimens, as found on the beach; $\frac{1}{25}$ natural size.

Figure 2.—The same. Dorsal view. The dotted lines indicate portions of the arms that had been destroyed; $\frac{1}{25}$ natural size.

Figure 3.—The same. Side view of the head and siphon, with the anterior part of the mantle, cut open; *e*, the eye; *s*, siphon; *o*, *o'*, *o''*, the three nuchal olfactory crests; *c*, *c'*, *c''*, the connective cartilages attaching the mantle to the neck; *c*, lateral cartilage of mantle; *c'*, lateral cartilage at base of siphon; *c''*, dorsal cartilage of neck; *m*, *m'*, cut edge of mantle.

Figure 4.—The same. The entire dorsal 'pen'; side view; $\frac{1}{2}$ natural size.

Figure 5.—The same. Ventral view.

Figure 6.—The same. A portion from the middle of the 'pen', less reduced.

All the figures were made from the fresh specimens by Mr. W. H. Dall.

Plate XIV.

Figure 1.—*Moroteuthis robusta* (Dall) Verrill. Odontophore; side view; enlarged $3\frac{1}{4}$ diameters.

Figure 2.—The same. Part of a row of the teeth from near the anterior bend of the odontophore; enlarged 22 diameters; *a*, median tooth, front view; *a'*, side view of same; *b*, first lateral; *b'*, the same, side view; *c*, second lateral, front view; *d*, outer lateral, front view.

Figure 3.—The same. One of the inner lateral teeth, side view; enlarged 54 diameters.

Figure 4.—The same. Median tooth, side view; enlarged 54 diameters.

Figure 5.—The same. Upper mandible, natural size.

Figure 6.—The same. Lower mandible, natural size.

Figure 7.—The same. Anterior end of terminal cone, showing a portion of the posterior end of the 'pen' inserted into it; $\frac{1}{2}$ natural size.

Figure 8.—The same. Section of a ventral arm, close to the base; natural size; *a'*, one of the suckers, side view; *b* and *b'*, marginal membranes; *c*, crest or membrane along outer angle; *e*, median vein, near inner surface.

Figures 1 to 4 are camera-drawings by the author; the rest are by J. H. Emerton.

Plate XV.

Figure 1.—*Lestoteuthis Fabricii* Verrill. Young. Pen; enlarged 2 diameters. Copied from G. O. Sars as *Gonatus amœnus*.

Figure 1*a*.—The same. Part of odontophore. Copied from G. O. Sars.

Figure 1*b*.—The same. Portion of tentacular club, front view; enlarged. Copied from G. O. Sars.

Figure 2.—The same. Young. General figure, dorsal view; enlarged 2 diameters From an American example.

Figures 2*a*, 2*b*.—The same. Front and side views of one of the suckers from the outer rows of a lateral arm of the same specimen.

Figures 2*c*, 2*d*.—The same. Front and side views of a hook-sucker from the median rows of the same arm.

Figure 3.—*Lestoteuthis Fabricii* Verrill (*Cheloteuthis rapax*). Club of tentacular arm, front view; enlarged 2 diameters. The horny hooks are lost from the claws *a*, *a'*, *a''*; *b*, *c*, small lateral suckers; *d*, *d'*, small suckers of distal portion; *e*, *e'*, connective suckers and tubercles.

Figure 3*a*.—The same specimen. One of the suckers corresponding to *c* of figure 1, front view; much enlarged.

Figure 3*b*.—The same specimen. A small sucker, corresponding to *d* of figure 1.

Figures 3*c*, 3*d*.—The same specimen. Front and side views of one of the claws, with its enclosed horny hook or 'nail', from the middle of a lateral arm; enlarged 8 diameters.

Figure 3*e*.—The same specimen. Connective cartilage from base of siphon, front view; enlarged 2 diameters.

Figure 3*f*.—The same specimen. Beak and pharynx, side view; enlarged 2 diameters.

Figure 4.—The same specimen. Teeth of the odontophore; enlarged 22 diameters.

Figure 5.—*Enoploteuthis Hartingii* Verrill. Two hooks, *a*, *b*, from the arms, side views; *c*, *d*, median and lateral teeth of the odontophore. After Harting.

Figure 6.—*Onychoteuthis Banksii*. One of the large hooks from the middle of the club; *a*, side view; *a'*, front view; *b*, *b'*, corresponding views of one of the smaller hooks of the club; *c*, side view; *c'*, front view of horny ring from one of the small suckers in the proximal cluster of connective suckers and tubercles of the club; enlarged 6 diameters.

Plate XVI.

Figure 1.—*Sthenoteuthis megaptera* Verrill. Type specimen. Body seen from beneath; ⅓ natural size; from the alcoholic specimen.

Figure 2.—The same specimen. Part of the membrane lining the palate; enlarged 8 diameters; *a* and *b* are from different places.

Figure 3.—The same specimen. A single row of teeth from the odontophore; enlarged 8 diameters.

Figure 4.—The same specimen. Teeth from the odontophore; enlarged 16 diameters; *a*, two median teeth; *b*, inner lateral teeth; *c* and *d*, teeth of the two outer lateral rows. Drawn from the detached teeth.

Figure 5.—The same specimen. Two of the outer lateral teeth, profile view; enlarged 16 diameters.

Figure 6.—The same specimen. Several lateral teeth in their natural sequence; enlarged 16 diameters.

Figure 7.—The same specimen. Two teeth from the next to the outer row; enlarged 16 diameters.

Figures 8 and 8*a*.—The same specimen. Twenty-second sucker of a ventral arm; front and side views, enlarged 2 diameters.

Figure 9.—The same specimen. One of the largest suckers from the club of the tentacular arm; front view; enlarged 2 diameters.

Figure 10. *Sthenoteuthis megaptera* V. from George's Bank. Large sucker from the tentacular club, front view; enlarged 2 diameters.

Figures 8, 8*a*, and 9 are by J. H. Emerton; the others are by the author; 2 to 7 are camera-drawings.

Plate XVII.

Figure 1.—*Sthenoteuthis megaptera* Verrill, from George's Bank. Beak and inner buccal membrane, front view; natural size.

Figure 2.—The same. Another specimen. Side view of jaws and odontophore; natural size.

Figure 3.—*Sthenoteuthis pteropus* Verrill, from Bermuda. Jaws; *a*, upper; *b*, lower mandible; natural size.

Figure 4.—The same specimen. Isolated teeth from odontophore; enlarged 25 diameters; *a*, median teeth, front view; *b*, inner lateral; *c*, middle lateral; *d*, outer lateral tooth.

Figure 5.—The same specimen. Anterior end of the pen; natural size.

Figure 5*a*.—Posterior end of the same pen.

Figure 6.—The same specimen. Connective cartilage from the base of the siphon; natural size.

Figure 7.—The same specimen. Transverse sections of some of the arms; *a*, of dorsal; *b*, of second pair; *c*, of third pair; natural size. The suckers are omitted.

Figure 8.—The same specimen. Rings of suckers of the sessile arms, enlarged 2 diameters; *a*, *a'*, side and front views of the 15th and 13th suckers of a ventral arm; *b*, *b'*, side and front view of one of the largest suckers of a lateral arm; *c*, *c'*, side and front views of one of the larger suckers of a dorsal arm.

Figure 9.—The same specimen. Part of the border of one of the larger suckers (12th) of the second pair of arms; more enlarged, showing part of the dentate edge of the horny ring, with a portion of the circle of small plates, attached to the membranous border.

Figures 4 and 7 are by the author; fig. 4 is a camera-lucida drawing.

Plate XVIII.

Figure 1, 1*a*.—*Ommastrephes illecebrosus* V. Young male from Provincetown, Mass. General figure of ventral side; $\frac{6}{7}$ natural size; 1*a*, club of the right tentacular arm, front view; $1\frac{5}{7}$ natural size.

Figure 2.—The same. Club and part of tentacular arm, of a larger female specimen; enlarged $1\frac{5}{7}$ diameters.

Figure 3, 3*a*.—The same. Hectocotylized right ventral arm of a large male specimen, from Eastport, Me., showing the sexual modification of the suckers and their peduncles toward the end of the arm; 3*a*, transverse section of the modified portion of the same.

Figure 4.—The same. Pen of a young specimen; $\frac{6}{7}$ natural size.

Figures 5 and 5*a*.—The same. Side and front views of a large sucker of the lateral arms; enlarged $\frac{5}{3}$ diameters.

Figures 6 and 6*a*.—The same. Side and front views of a smaller distal sucker of the lateral arms; enlarged $\frac{5}{3}$ diameter.

Figure 7.—The same. ♀. Side view of the horny ring of one of the largest suckers of the club; enlarged $3\frac{3}{4}$ diameters.

Figure 8.—The same. From Eastport, Me. Part of the teeth of the odontophore, in their natural positions; enlarged 10 diameters; *a*, median teeth; *b* and *b'*, inner lateral teeth; *c*, middle lateral teeth; *d*, outer lateral teeth.

Plate XIX.

Figure 1.—*Ommastrephes illecebrosus*. Male, $\frac{1}{3}$ natural size. Opened on the ventral side. The peritoneal membrane, most of the renal organs on the right side, and the reproductive organs, except the testicle (*t*), have been removed. M, mantle cut open; F, caudal fin; P, posterior part of pen; S, stomach; S', cæcal lobe; H, systemic heart; *e*, the eye; *b*, olfactory or nuchal crests; *d*, siphon; *f*, *f*, connective cartilages on the base of the siphon; *f'*, *f'*, connective cartilages of the mantle, which fit into *f*, *f*; *m'*, lateral muscles of neck; *g*, *g*, gills; *l*, liver; *i*, ink-sac; *h*, intestine or rectum; *a o*, anterior aorta, going to head; *b o*, efferent branchial vessel; *o*, median ventral artery of mantle; *o'*, *o'*, lateral arteries going to mantle and fins; *a u*, branchial auricles; *v c*, anterior vena-cava; *v c''*, posterior vena-cava of left side (the right one has been removed); *r r*, saccular ventral renal organs; *r'*, more compact glandular (renal) organ, connected with the posterior venæ-cavæ; *t*, testicle or spermary; *p''*, hooded posterior tip of pen, inclosing the end of the spermary. From an alcoholic specimen.

Figure 2.—The same. Jaws; enlarged $1\frac{1}{2}$ diameters; *a*, superior; *b*, inferior mandible.

Figure 3.—The same. Part of the teeth of the odontophore in their natural positions, enlarged 25 diameters; *a*, median teeth; *b* and *b'*, inner lateral teeth; *c*, middle lateral teeth; *d*, outer lateral teeth.

Figure 4.—The same. Side view of the head and siphon, after removal of part of the mantle, ⅔ natural size; 1, 2, 3, 4, bases of 1st to 4th pairs of sessile arms; *t a*, base of tentacular arm; *m*, mantle; *b*, *b'*, olfactory crests around the ear; *d*, siphon; *f*, *f*, one of the connective cartilages for attaching it to the mantle.

Figure 4*a*.—The same. Lateral connective cartilage, *n*, on the inside of the mantle, which fits closely into the cartilage pit (*f*) on the base of the siphon.

Figures 5 and 5*a*.—The same. Side and front views of one of the larger suckers of the lateral arms; enlarged 4 diameters.

Figures 6 and 6*a*.—The same. Side and front views of a smaller distal sucker of the lateral arms; enlarged 4 diameters.

Figure 3 is from a camera-lucida drawing by the author.

Plate XX.

Figure 1.—*Ommastrephes illecebrosus* Verrill. Female; less than natural size. Lettering as in Plate 19, figure 1, with the following additional letters: *b''*, lower nuchal facet, with the auditory pore; *u*, urethreal openings in the peritoneal membrane, communicating between the gill-cavity and the visceral cavity, containing the renal organs, *r*, *r*; *v c'*, lateral pallial veins, or venæ-cavæ; *o v*, ovary; *o d*, *o d'*, right and left oviducts; *o p*, the anterior opening; *o x*, *x x*, nidamental glands.

Figure 2.—*Loligo Pealei*, var. *pallida*. Anatomy of the alimentary canal, &c.; ¾ natural size. The organs are shown nearly in a dorsal view, except the jaws, which are viewed from the side and in section; *b m*, buccal membrane; *s m*, section of superior mandible; *i m*, of inferior mandible; *o d*, of odontophore, with teeth; *o e*, *o e'*, œsophagus; *s g*, salivary glands; *s d*, salivary duct; *g l*, subœsophageal ganglion; *l l*, liver; *ao*, *ao*, anterior aorta, running parallel with the œsophagus along and through the liver; S, first stomach; S', second stomach or cœcal appendage; S'', third stomach, strongly plicated within; *h*, intestine or rectum; *h'*, anal orifice and papillæ; *i*, ink-sac; *i'*, orifice of its duct; H, ventricular heart; *bo*, cut end of one of the branchio-cardiac vessels; *g o*, genital artery, going to testicle; *so*, *so*, branches of gastric artery; *t*, testicle or spermary; *v d*, vas deferens; *p r*, prostate gland and vesiculæ seminales; *s s*, spermatophore-sac; *p*, 'penis' or efferent duct.

Plate XXI.

Figure 1.—*Mastigoteuthis Agassizii* Verrill. Dorsal view; slightly enlarged.

Figure 1*b*.—The same. Pen; ventral view; enlarged 2 diameters.

Figure 1*c*.—The same. Side view of the same pen.

Plate XXII.

Figure 1.—*Calliteuthis reversa* Verrill. Ventral view; natural size.

Figure 1*a*.—The same. Beak, buccal membranes and base of arms; front view; natural size.

Figure 1*b*.—The same. One of the larger suckers from a lateral arm; much enlarged.

Figure 1*c*.—The same. Pen; ventral view; somewhat enlarged.

Figure 2.—*Mastigoteuthis Agassizii* Verrill. Front view of the beak, buccal membranes (*b*, *d*), and bases of the arms; enlarged 2 diameters.

Figure 2*a*.—The same. Side view of head, siphon, and anterior part of mantle, showing the cartilage (*c*), on the inner surface of the mantle, which interlocks with *c'* on the base of the siphon; *e*, olfactory (?) papilla near the ear; *p*, an aquiferous pore (?); *s*, siphon; *t a*, base of tentacular arms; 1, 2, 3, 4, bases of corresponding pairs of arms.

Figure 2*b*.—The same. Portion from near the end of one of the tentacular arms; enlarged 16 diameters.

Figure 2*c*.—The same. Suckers from the tentacular arm; much enlarged; *a*, side view; *a'* and *a''*, front views.

Figure 2*d*.—The same. One of the suckers from the middle of a lateral arm; front view; much enlarged.

Figure 2*e*.—The same. Three rows of teeth on the radula, in their natural positions; enlarged nearly 50 diameters.

Plate XXIII.

Histioteuthis Collinsii Verrill. Side view of the head and arms; from the preserved specimen; $\frac{3}{8}$ natural size. Drawn by J. H. Emerton.

Plate XXIV.

Figure 1.—*Desmoteuthis hyperborea* V. Ventral view of a female; $\frac{1}{2}$ natural size.

Figure 2.—The same specimen. Dorsal view of the head and arms. Part of the arms are imperfect.

Figure 2*a*.—The same. One of the arms, left of the third pair; natural size.

Figure 2*b*.—The same. One of the larger suckers from the middle of third pair of arms; front view; enlarged 8 diameters.

Figure 3.—*Histioteuthis Collinsii* V. Original type. One of the tentacular arms; front view; $\frac{3}{4}$ natural size.

Figure 4.—Beak of the same specimen; *a*, upper; *b*, lower mandible; natural size.

Figure 5.—Suckers of the same specimen; *a*, side, and *a'*, front view of one of the larger suckers of lateral arm; *b*, side, and *b'*, front view of a distal sucker; enlarged $2\frac{1}{4}$ diameters.

Figure 6.—The same specimen. Teeth of the odontophore; isolated and enlarged 25 diameters; *a*, median; *b*, inner lateral; *c*, and *d*, outer laterals; *e*, marginal plate; *h*, *g*, and *f*, other views of the lateral teeth. The teeth are not drawn in their natural positions.

Figure 7.—The same specimen. Teeth on the radula in their natural positions; enlarged 22 diameters.

Figure 6 is from a camera-lucida drawing by the author.

Plate XXV.

Figure 1.—*Desmoteuthis hypoborea* Verrill. Female; about $\frac{1}{4}$ natural size. Specimen opened on the ventral side. M, mantle; F, caudal fin; P, P', posterior part of pen; *e*, *e*, eyes; *d*, siphon; *d o*, aperture of same; *d''*, base and posterior entrance of same; *f'*, commissure attaching the siphon to the mantle laterally; *g*, *g*, gills; *i*, ink-sac; S', first stomach, or gizzard; S, S, lobes of stomach; S'', cœcal lobe; *l*, *l*, long, tubular intestine, plicated within, and with clusters of follicular glands externally along the sides; *h*, rectum; *j*, liver; H, systemic heart or ventricle; *b o*, branchial efferent vessels; *a*, *u*, branchial auricles; *v c''*, posterior vena-cava; *r'*, renal organs; *o v*, ovary; *o v'*, some ovules larger than the rest; *o p*, *o p'*, right and left oviducts; *x'*, nidamental glands of the oviducts; *x x*, *x x'*, accessory nidamental glands. From a somewhat mutilated specimen.

Figure 1*a*.—The same. Pen; ventral view; $\frac{1}{2}$ natural size.

Plate XXVI.

Figure 1.—*Loligo Pealei* Lesueur. Female from Vineyard Sound. Ventral view; $\frac{3}{4}$ natural size; 1, dorsal arms; 2, 3, 2d and 3d lateral arms; 4, ventral arms; *t*, tentacular arms; *a*, ventral olfactory crests around the ear; *e*, eye; *p*, aquiferous pore; *s*, siphon.

Figure 2.—The same. Tentacular arm of a large male; enlarged $1\frac{1}{2}$ diameters.

Figures 3, 3*a*.—Front and side views of the hectocotylized left ventral arm of a male, showing the sexual modifications of the suckers and their peduncles, toward the tip; enlarged $1\frac{1}{2}$ diameters.

Figure 4.—The same. Female; front view of the beak and buccal membranes; natural size; *m*, mandibles; *f*, inner fold; *c*, second fold of the buccal membrane; *a*, dorsal; *b*, *c*, lateral; *d*, ventral angles of the outer buccal membrane, with their small suckers; *s*, peculiar horseshoe-shaped tubercle, for the attachment of the spermatophores during copulation.

PLATE XXVII.

Figure 1.—*Loligo Pealei*, var. *borealis*. Female specimen, from Annisquam, Mass. Pen; natural size. Represented as flattened to show the full width of the thin portion.

Figure 2.—*Loligo Pealei* Les. Female specimen, from Vineyard Sound. Pen; natural size; represented as before in the same manner.

Figure 3.—The same. Pen of a young specimen from Vineyard Sound; natural size. Represented in the same way.

Figure 4.—The same. Pen of a male; $\frac{3}{4}$ natural size. Viewed in the same manner as figures 1 and 2.

Figure 4*a*.—The same. Pen; side view of tip; enlarged.

Figure 5.—*Loligo Gahi* D'Orb. Pen; $\frac{3}{4}$ natural size.

PLATE XXVIII.

Figure 1.—*Loligo Pealei*, var. *pallida* Verrill. Male, from Ansonia, N. Y. Dorsal view; abont $\frac{1}{4}$ natural size.

Figure 2.—The same. Pen; about $\frac{1}{8}$ natural size.

Figure 3.—The same. Male. Suckers enlarged 3 diameters; *b'*, front view of tenth, from third arm; *b*, side view of the same; *c*, side view of the horny ring of the fifth large sucker of the tentacular club; *c'*, front view of the same.

Figure 4.—The same. Female. Suckers: *a*, lateral, and *a'*, front view of tenth sucker from the third pair of arms; *e*, side, and *e'*, front view of the fifth large sucker of the tentacular arm; enlarged 3 diameters.

Figure 5.—The same. Upper mandible: *a*, rostrum or tip of the beak; *b*, the notch; *c*, the inner end of ala; *d*, the frontal lamina; *c*, the palatine lamina; *a b*, the cutting edge of beak; *b c*, anterior or cutting edge of ala.

Figure 5*a*.—The same. Lower mandible: *a*, rostrum; *a b*, cutting edge; *b c*, anterior edge of ala; *d*, mentum or chin; *e*, gular lamina.

Figure 6.—The same. Part of the teeth of the odontophore; enlarged 50 diameters; *a*, median tooth, front view; *c*, next to outer lateral teeth; *d*, outer lateral teeth; *e*, marginal plates; all are in their natural positions, except *a*.

Figure 7.—The same. Portion of the radula; enlarged 22 diameters.

Figure 8.—*Loligo Pealei*. Portion of the radula; enlarged about 20 diameters.

Figures 9, 9*a*.—The same. Male; side and front views of the horny ring of one of the marginal suckers of the tentacular club; enlarged 10 diameters.

Figure 10.—Teeth on the lining membrane of the palate; enlarged 25 diameters.

Figure 11.—*Chiroteuthis lacertosa*. One of the tentacular suckers; front view; enlarged 75 diameters.

Figure 11*a*.—The same sucker, with pedicel; front view; enlarged 22 diameters.

Figures 5 and 5*a* were drawn by the author; figure 9 was drawn by J. H. Blake, from nature; the rest, by J. H. Emerton.

PLATE XXIX.

Figure 1.—*Loligo Pealei*, var. *pallida*. Male. Ventral view; about $\frac{3}{4}$ natural size. The mantle has been cut open, a little to one side of the median line; most of the peritoneal membrane has been removed. C, lower side of head; M, mantle; F, caudal fin; *a*, lachrymal pore; *a'*, muscles; *b*, olfactory crests; *c*, eye; *d*, siphon, cut open; *d''*, cavity of siphon; *e*, valve of siphon; *f*, one of the connective cartilages of the siphon; *f'*, one of the connective cartilages of the mantle, in the form

of a ridge, fitting into the siphonal cartilage; *g*, left gill; *h*, rectum; *h'*, termination of the intestine or rectum; *i*, ink-sac; *i'*, duct of ink-sac; *l*, portion of liver, in position; *m'*, *m'*, muscular columns connecting the head and siphon with dorsal portion of the body; H, systemic heart, or ventricle, crossed by the artery of the ink-sac; *a o*, bulbous base of anterior aorta; *o*, ventral pallial artery, or median branch of the posterior aorta, supplying the ventral parts of the mantle; *o'*, one of the caudal arteries or lateral branches of the posterior aorta going to the caudal fin and posterior parts of the mantle; *a u*, *a u*, branchial auricles; *b v*, afferent vessel going to the gills; *b o*, efferent branchial vessels, returning the blood to the ventricle, their swollen basal portions acting as auricles; *v c*, anterior vena-cava; *r*, *r*, ventral renal organs, two ventral sacculated branches of the vena-cava (on the left side, the vein from the ink-sac and rectum is shown); *r'*, *r'*, two pyriform renal organs, or sacculated and glandular portions of the posterior venæ-cavæ, directly connected with *r*, *r*; *r*, *v c'*, lateral pallial veins, going to the dorsal sacculated divisions of the venæ-cavæ; *v c''*, *v c''*, two posterior venæ-cavæ, returning from the caudal fin and mantle; S, the first stomach, or gizzard; S', large, saccular cœcal appendage of the stomach; S'', glandular, plicated stomach, in continuation with the anterior portion of S'; *t*, spermary or testicle; *p r*, prostate gland, with the vesiculæ-seminales and spermatophore-sac; *p*, efferent sperm-duct or 'penis'; P, posterior portion of the pen.

Figure 2.—The same. Dorsal view of the reproductive organs, part of the renal organs, heart, etc., dissected out. The lettering is as in figure 1, with the following additions: *v d*, *v d'*, vas-defcrens, closely folded upon itself; *v s*, vesiculæ-seminales; *s s*, spermatophore-sac; *p o*, genital artery; *g o*, spermatic artery and vein; *p t*, part of peritoneal membrane.

Figure 3.—*Loligo Pealei.* Female in the breeding season. Oviduct, filled with ova, dissected out. Ventral view, about ½ natural size; *v o*, commencement of convoluted, thin membranous portion of oviduct; *o d*, entrance to glandular portion; *o d'*, glandular portion of oviduct, surrounded by the large, laminated gland, *x'*, the arterial vessels of which have been injected; *o p*, orifice of the oviduct.

Figure 3*a*.—The same specimen, seen from the dorsal side.

Figures 2, 3 and 3*a* are from drawings by the author.

PLATE XXX.

Figure 1.—*Loligo Pealei.* Embryo taken from the egg, ventral view, much enlarged; *a*, *a*, *a*, ventral arms, tentacular arms, and third pair of sessile arms; *c*, *c*, eyes on stout peduncles or lobes from the sides of the head; *m*, mantle-edge; *h*, branchial auricles; *y*, unabsorbed yolk-mass.

Figure 2.—The same. An embryo, within the egg, somewhat more advanced than figure 2, side view, less enlarged. The lettering is as in figure 2, with the following additions: *a'*, second pair of arms; *a''*, third pair; *a'''*, tentacular arms; *a''''*, ventral arms; *s*, orifice of siphon; *o*, otoliths; *f*, rudimentary caudal fins. Chromatophores are developed on the mantle.

Figure 3.—The same. An embryo at the period of hatching. Ventral view, enlarged about 15 diameters. The yolk-sac (*y*) is nearly absorbed; a^3, third pair of sessile arms; *t a*, tentacular arms; *v a*, ventral arms; *b*, beak; *l*, odontophore; *r*, teeth on the radula; *s*, siphon; *o t*, otolith; *m*, mantle; *f*, caudal fin; *g*, *g'*, gills; *i*, ink-sac; *t*, rectum; *h'*, *h'*, branchial auricles; *u*, *u'*, rudiments of the stomach.

Figure 4.—The same. Young, just hatched, seen as a transparent object, enlarged 6 diameters; from a specimen raised from the eggs at Newport, R. I., August 5th. Ventral view; a^3, the third pair of arms; *t a*, tentacular arms; *va*, ventral arms; the suckers show on *t a*, the tentacular arms; *b*, the beak; *l*, odontophore; *e*, the eye; *f*, caudal fin; *g*, gill; *h*, ventricle of the heart; *h'*, *h'*, branchial auricles; *i*, ink-bag; *m*, mantle; *o t*, otoliths; *s*, siphon; *s'*, base of siphon; *t*, end of intestine; *u*, stomach; *y*, portion of yolk-sac, not yet absorbed. The chromatophores are omitted.

Figure 5.—The same. A somewhat older larva, taken swimming at the surface. Dorsal view; enlarged about 7 diameters. The dorsal arms are still very small; the tentacular arms are much the largest; the chromatophores are large and symmetrically arranged, but only a part of them are shown in the figure; the caudal fins do not reach the posterior end.

Figure 6.—The same. Young female. Dorsal view of a specimen taken at Newport, R. I., in August. Enlarged 2 diameters. From a fresh specimen.

Figure 7.—The same. One of the egg-capsules, slightly enlarged.

Figure 8.—The same. A very young embryo, earlier than figure 1; dorsal view; *a*, rudiments of the arms; *o*, otoliths; *s*, inner folds of the siphon; *g*, rudiments of the gills; *e*, "eye-stalks," or swellings of the sides of the head; *m*, mantle; *p*, shell-area; *y*, yolk.

Figures 1 and 2 are from camera-drawings by the author; figure 8 is copied from Brooks; the rest are by J. H. Emerton.

Plate XXXI.

Figure 1.—*Loligo Pealei*. Portion of middle of club, showing the four rows of suckers; enlarged 4 diameters. From an individual having larger suckers than usual.

Figure 2.—The same. Portion of the middle of the tentacular club of a specimen from the same lot and of nearly the same size as figure 1, but having small tentacular suckers; enlarged 4 diameters; *a*, *a'*, largest median suckers; *b*, *b'*, lateral suckers.

Figure 3.—The same. Portion of the horny ring and marginal denticles of one of the large median suckers of the tentacular club; much enlarged.

Figure 4.—*Loligo brevis* Bv. Female. Dorsal view; natural size.

Figure 4*a*.—The same specimen. Pen; natural size.

Figure 4*b*.—The same. Portion of horny ring and marginal scales of one of the large tentacular suckers; much enlarged.

Figure 4*c*.—The same sucker; less enlarged; front view. From a mounted specimen which, by contracting, has everted the denticulated border of the rim.

Plate XXXII.

Figure 1.—*Chiroteuthis lacertosa* Verrill. One of the tentacular arms, outer side; natural size.

Figure 1*a*.—The same. Front view of club; enlarged 2 diameters.

Figure 1*b*.—The same. One of the suckers, front view; enlarged 10 diameters.

Figure 2.—*Loligo Pealei*, var. *borealis*. Female, in the breeding season. Ventral view; about ½ natural size. The mantle has been cut open nearly in the median line and the peritoneal membrane partly removed. The lettering is the same as in figure 1 of Pl. XXIX, with the following additions: 1, 2, 3, 4, first, second, third, and fourth pairs of sessile arms: *t a*, tentacular arms; *d'*, external orifice of siphon; *o v*, *o v'*, ovary, mostly concealed by the oviduct; *v o*, commencement of glandular portion of oviduct; *x'*, large gland surrounding the oviduct; *o d'*, anterior portion of oviduct; *op*, orifice of oviduct; *x x*, pair of large, ventral, laminated, nidamental glands; *x*, pair of folliculated and mottled, accessory nidamental glands; *u*, one of the urethral openings of the peritoneal membrane.

Figure 3.—The same. Section of gill; enlarged about 8 diameters; *a*, one of the lamellæ with the efferent vessel along its edge; *a'*, its outer end; *b o*, the main effereut or branchio-cardiac vessel, returning the blood to the heart; *b v*, the main branchial vein, or efferent vessel; *b*, one of the branches supplying a lamella; *v*, another vein in the muscular stem, *c*; *d*, membrane uniting the gill to the mantle; *e*, membrane running across the dorsal side of the gill.

PLATE XXXIII.

Figure 1.—*Heteroteuthis tenera* Verrill. Front view of male; enlarged 2 diameters.
Figures 1*a*, 1*b*.—The same. Front and side views of one of the larger suckers of the lateral arms of the same specimen; more enlarged.
Figure 2.—The same. Jaws, side view; enlarged 4 diameters; *a*, superior; *b*, inferior mandible.
Figure 2*a*.—The same. Tentacular club; enlarged 5 diameters.
Figure 2*b*.—The same. Pen; enlarged 6 diameters.
Figure 2*c*.—The same. Part of the radula; much enlarged.
Figure 2*d*.—The same. Part of the radula; more enlarged.
Figure 3.—The same. Dorsal view of a male; enlarged 2 diameters.
Figure 3*a*.—The same. One of the larger marginal suckers of the tentacular club, front view; much enlarged.
Figure 3*b*.—The same. Portion of the margin of the sucker, more enlarged, to show the scales.

PLATE XXXIV.

Figure 1.—*Heteroteuthis tenera* Verrill. Dorsal view of female; enlarged 2 diameters.
Figure 1*a*.—The same. A group of eggs; enlarged 2 diameters.
Figure 2.—*Rossia sublevis* Verrill. ♀. Dorsal view; natural size.
Figure 2*a*.—The same. One of the suckers of the tentacular club, side view; much enlarged.
Figure 2*b*.—The same. Marginal scales on the edge of the same sucker; more enlarged.
Figure 3.—The same. Pen, ventral view; enlarged 6 diameters.
Figure 4.—The same. Ventral view; enlarged 1½ diameters.
Figure 5.—The same. One of the arms of the third pair, from another female example; enlarged 3 diameters.
Figure 6.—The same. Corresponding arm of the male; enlarged 3 diameters.

PLATE XXXV.

Figure 1.—*Histioteuthis Collinsii* Verrill. One of the largest median suckers of the tentacular club; side view; enlarged 4 diameters.
Figure 1*a*.—The same. One of the suckers from next to the outer row, of the same club; enlarged 4 diameters.
Figure 2.—*Rossia Hyatti* Verrill. Side view of young male; enlarged 1½ diameters; from life.
Figure 3.—*Rossia megaptera* Verrill. Female; dorsal view; natural size.
Figure 4.—The same. Suckers; enlarged 22 diameters; *a*, front view of one of the largest from the third pair of arms; *b*, *c*, *d*, three suckers from the tentacular club.
Figure 5.—*Rossia Hyatti* Verrill. Egg containing an embryo; enlarged 6 diameters. The shaded portion represents the yolk still remaining unabsorbed.
Figure 6.—The same. Pen; enlarged 6 diameters.

PLATE XXXVI.

Figure 1.—*Stoloteuthis leucoptera* Verrill. Male: from a specimen taken in 1879; enlarged 1½ diameters.
Figure 1*a*.—The same specimen. Male; upper lateral arm, showing the greatly enlarged, middle suckers; enlarged 4 diameters.
Figure 2.—The same. Young female; ventral view; enlarged 3 diameters.
Figure 3.—*Rossia Hyatti* Verrill. A young specimen; enlarged 1½ diameters.
Figure 4.—The same. Adult female; dorsal view; enlarged 1½ diameters.
Figure 5.—The same. Female; suckers; enlarged 22 diameters; *a*, one of the largest from third pair of arms, side view; *b*, *c*, two forms of suckers from the tentacular club.
Figure 6.—The same. Lateral arm of a male; enlarged 3 diameters.

PLATE XXXVII.

Figure 1.—*Rossia Hyatti* Verrill. Female; ventral view of the head and arms; enlarged 3 diameters.

Figure 2.—*Rossia sublevis* Verrill. Female; ventral view of the head and arms; enlarged 3 diameters.

PLATE XXXVIII.

Figure 1.—*Stauroteuthis syrtensis* Verrill. Dorsal view; $\frac{3}{10}$ natural size.

Figure 2.—The same. Lower side of head; *s*, siphon; *e*, eye; *a*, the auditory pore.

Figure 3.—The same. The siphon, turned back.

Figures 4 and 5.—The same. Superior and inferior mandibles; enlarged $2\frac{2}{3}$ diameters.

This plate was drawn by the author, from the alcoholic specimen, except figures 4 and 5, which are by J. H. Emerton.

PLATE XXXIX.

Figure 1.—*Alloposus mollis* Verrill. Young male; side view, showing the sac containing the hectocotylized arm, cut open, so as to expose the partially developed arm; $\frac{1}{2}$ natural size.

Figure 1*a*.—The same specimen. Hectocotylized arm removed from the sac; enlarged 2 diameters.

Figure 2.—The same. Young female; ventral view; $\frac{1}{2}$ natural size.

Figure 2*a*.—The same specimen. Dorsal view; $\frac{1}{2}$ natural size.

PLATE XL.

Figure 1.—*Octopus piscatorum* Verrill. Female; original type. Ventral view; $\frac{2}{3}$ natural size.

Figure 1*a*.—The same specimen. Dorsal view.

Figure 2.—*Parasira catenulata* Steenst. Female; front view; $\frac{1}{2}$ natural size.

Figure 2*a*.—The same specimen. Side view of body and head; $\frac{1}{2}$ natural size.

PLATE XLI.

Figure 1.—*Octopus Bairdii* Verrill. Male; ventral view; natural size; *h*, terminal spoon-shaped organ of the hectocotylized arm; *i*, the groove along the lower side of the arm.

Figure 1*a*.—The same specimen. Hectocotylized arm; enlarged 2 diameters.

Figure 2.—The same. Male; figured in the act of swimming; dorsal view; *a*, terminal spoon of hectocotylized arm. From a living specimen; nearly natural size.

Figure 3.—*Octopus Bairdii* var. Verrill. Side view of a young male, enlarged about $1\frac{1}{2}$ diameters.

Figure 3*a*.—The same specimen. Terminal appendage of the hectocotylized arm; more enlarged.

PLATE XLII.

Figure 1.—*Octopus Bairdii* Verrill. Male; dorsal view from a living specimen; nearly natural size.

Figure 2.—The same. Side view, from life; nearly natural size.

Figure 3.—The same. Jaws; *s*, superior; *i*, inferior mandibles; enlarged 2 diameters.

Figure 4.—The same. Portion of odontophore; enlarged 22 diameters.

Figure 5.—The same. Spermatophores. A, one with the inner sac (*S*) partly extruded; *i*, the point from which the extension commences; enlarged $1\frac{1}{2}$ diameters; B, another spermatophore in its original condition; *a*, filament at large end; *b*, filament at small end.

Figure 6.—*Octopus obesus* Verrill. Male; original type. Basal portion of one of the lateral arms, to show the arrangement of suckers; enlarged $1\frac{1}{2}$ diameters.

Figure 6*a*.—The same. Terminal portion of the hectocotylized arm; enlarged 2 diameters.

Figure 7.—*Alloposus mollis* Verrill. Part of a large mutilated specimen. Portion of an arm, with suckers, from near the base: natural size.

Plate XLIII.

Figure 1.—*Octopus lentus* Verrill. Female; original specimen. Ventral view; ⅔ natural size.

Figure 2.—The same specimen. Dorsal view; ⅔ natural size.

Plate XLIV.

Figure 1.—*Alloposus mollis* Verrill. An entire, detached, mature hectocotylized arm; ¾ natural size.

Figure 2.—*Octopus lentus* Verrill. Side view of a male; enlarged about 1½ diameters.

Figure 3.—*Eledone verrucosa* Verrill. Side view of a male; ⅔ natural size.

Figure 3*a*.—The same specimen. Distal portion of the hectocotylized arm, to the edge of the basal web, showing the terminal appendage and the lateral groove.

Plate XLV.

Figure 1.—*Lestoteuthis Fabricii* V. One of the tentacular arms; enlarged 2 diameters.

Figure 1*a*.—The same. The larger claw; side view.

Figure 1*b*.—The same. Lateral arm; enlarged 2 diameters.

Figures 1*b'*, 1*b''*.—The same. One of the hooks; enlarged 4 diameters.

Figure 1*c*.—The same. Portion of ventral arm; enlarged 2 diameters.

Figure 1*d*.—The same. Pen, ventral view; a little less than natural size.

Figure 2.—*Desmoteuthis tenera* V. General figure of male, dorsal view; natural size.

Figure 2*a*.—The same. Teeth of odontophore; enlarged 22 diameters.

Figure 2*b*.—The same. One of the larger suckers of the lateral arms; front view; enlarged 8 diameters.

Figure 2*c*.—The same sucker; side view.

Figure 2*d*.—Valve-like apparatus within base of siphon; larger than natural size; *S*, orifice of siphon; *m*, median organ; *i'*, lateral papilla, and *i*, medio-dorsal papilla; *n*, *n'*, lateral cushions.

Figure 3.—*Brachioteuthis Beanii* Verrill. Dorsal view of the male; natural size.

Figure 3*a*.—The same. Pen, ventral view; enlarged slightly.

Figure 3*b*.—The same. Teeth of the radula; enlarged 22 diameters.

Figure 4.—*Desmoteuthis hyperborea*. Side view of one of the large suckers of the 3d pair of arms; side view; enlarged 8 diameters.

Figure 4*a*.—The same. Peculiar organs on the interior of the medio-dorsal side of the base of the siphon; enlarged 2 diameters; *i*, median, *i'*, lateral papillæ.

Figure 5.—*Chiroteuthis lacertosa* V. Young female. One of the suckers of the tentacular arms; front view; enlarged 22 diameters.

Figure 6.—*Histioteuthis Collinsii*. One of the larger suckers of the median rows of the tentacular club; side view; enlarged 2 diameters.

Figure 6*a*.—The same. One of the suckers of the sublateral rows of the tentacular club.

Plate XLVI.

Figure 1.—*Chiroteuthis lacertosa* Verrill. Dorsal view of the male; a little less than three-quarters natural size; *t a*, stump of one of the tentacular arms, with a few of the sessile suckers remaining.

Figure 1*a*.—The same. Ventral view of the pen; enlarged about 3 diameters.

Figure 1*a'*.—The same. Section of the anterior part of the pen; 1*a''*, section of the posterior part of the pen; much enlarged.

Figure 1*b*.—The same. Connective cartilage of siphon; enlarged 3 diameters.

Figure 1*c*.—The same. Lateral connective cartilage of mantle.

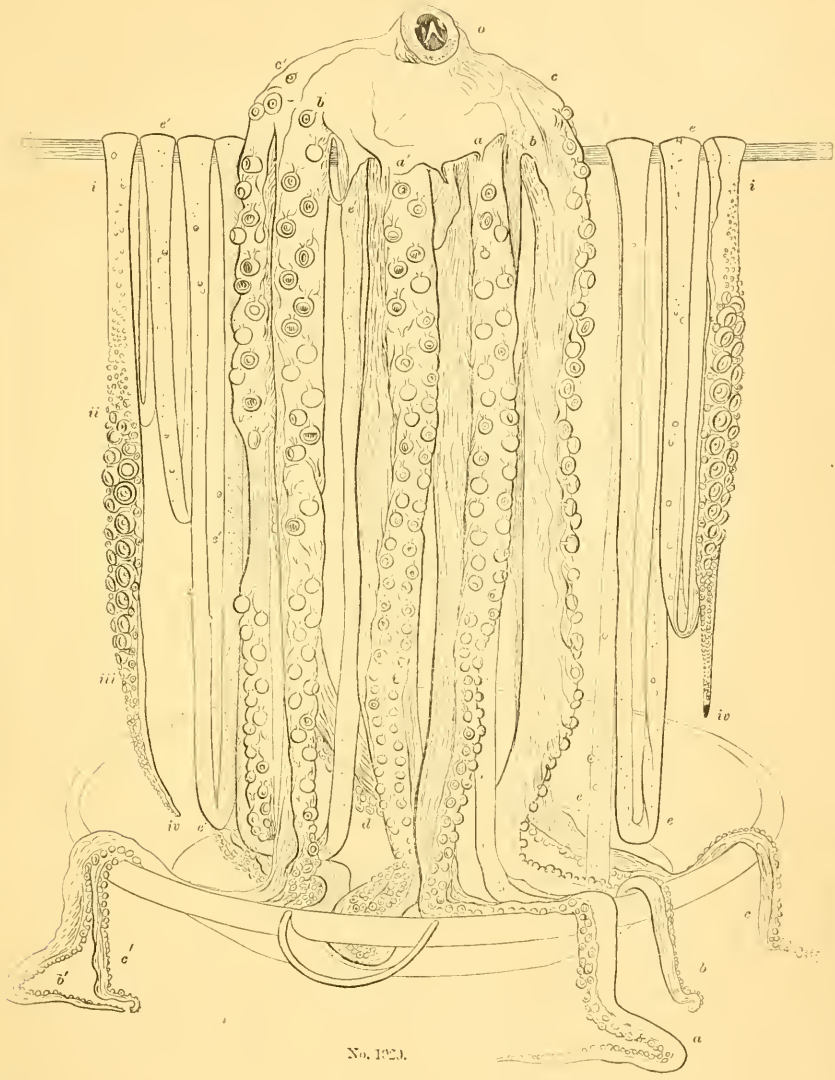
Figures 1*d*, 1*e*.—The same. One of the larger suckers of the 3d pair of arms; front and side views; enlarged 6 diameters.

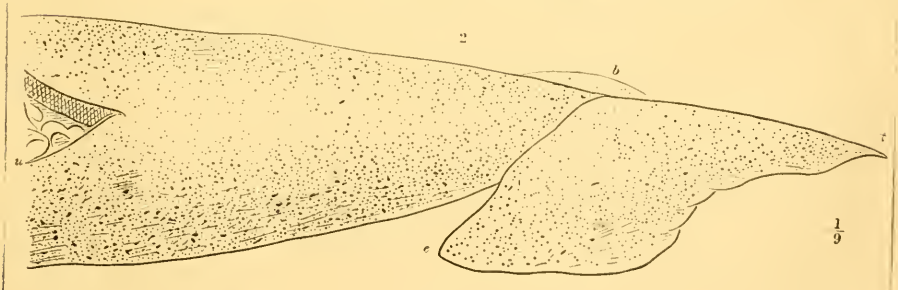
Figure 1*f*.—The same. Papilla, or rhinophore, from behind and below the eye; enlarged 3 diameters.

Figure 2.—*Brachioteuthis Beanii* V. Connective cartilage of the mantle; enlarged.

Figure 2*a*.—The same. Lateral connective cartilage of the siphon; enlarged.

Figure 3.—*Desmoteuthis tenera* V. Tentacular arm; enlarged 3 diameters.





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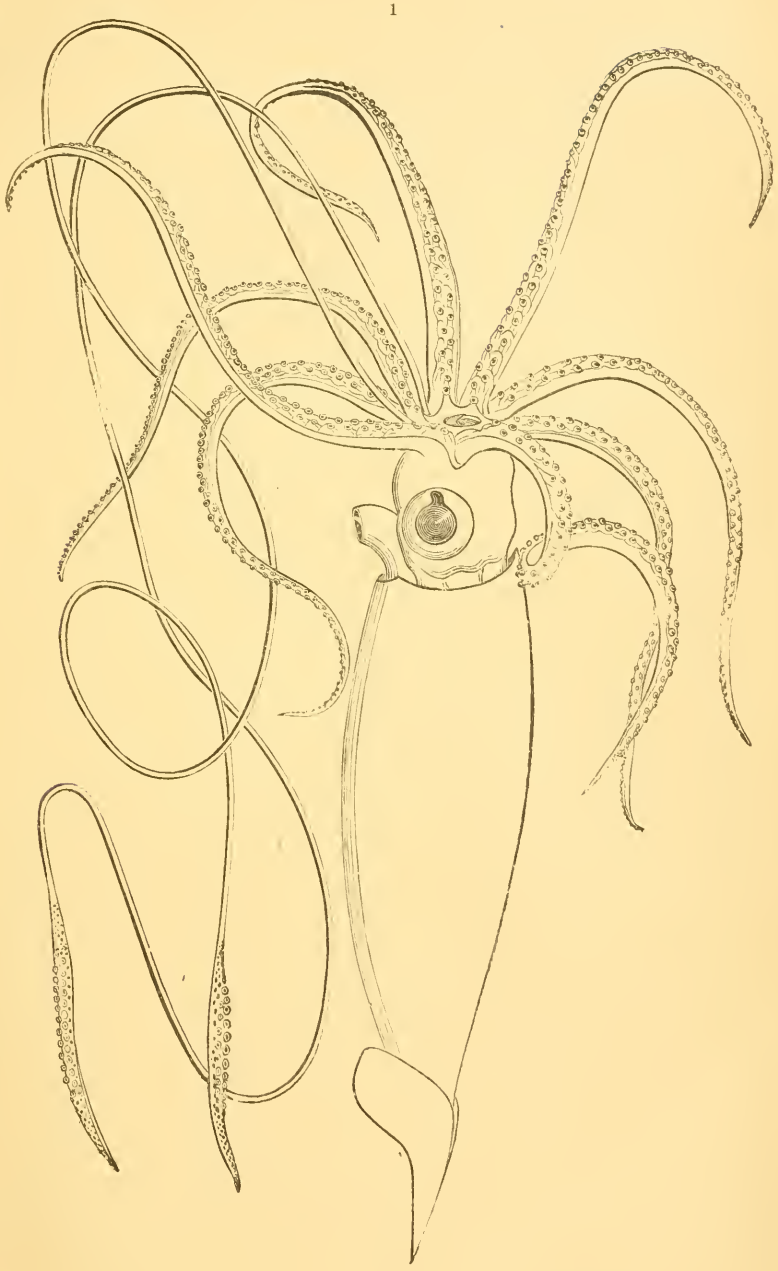

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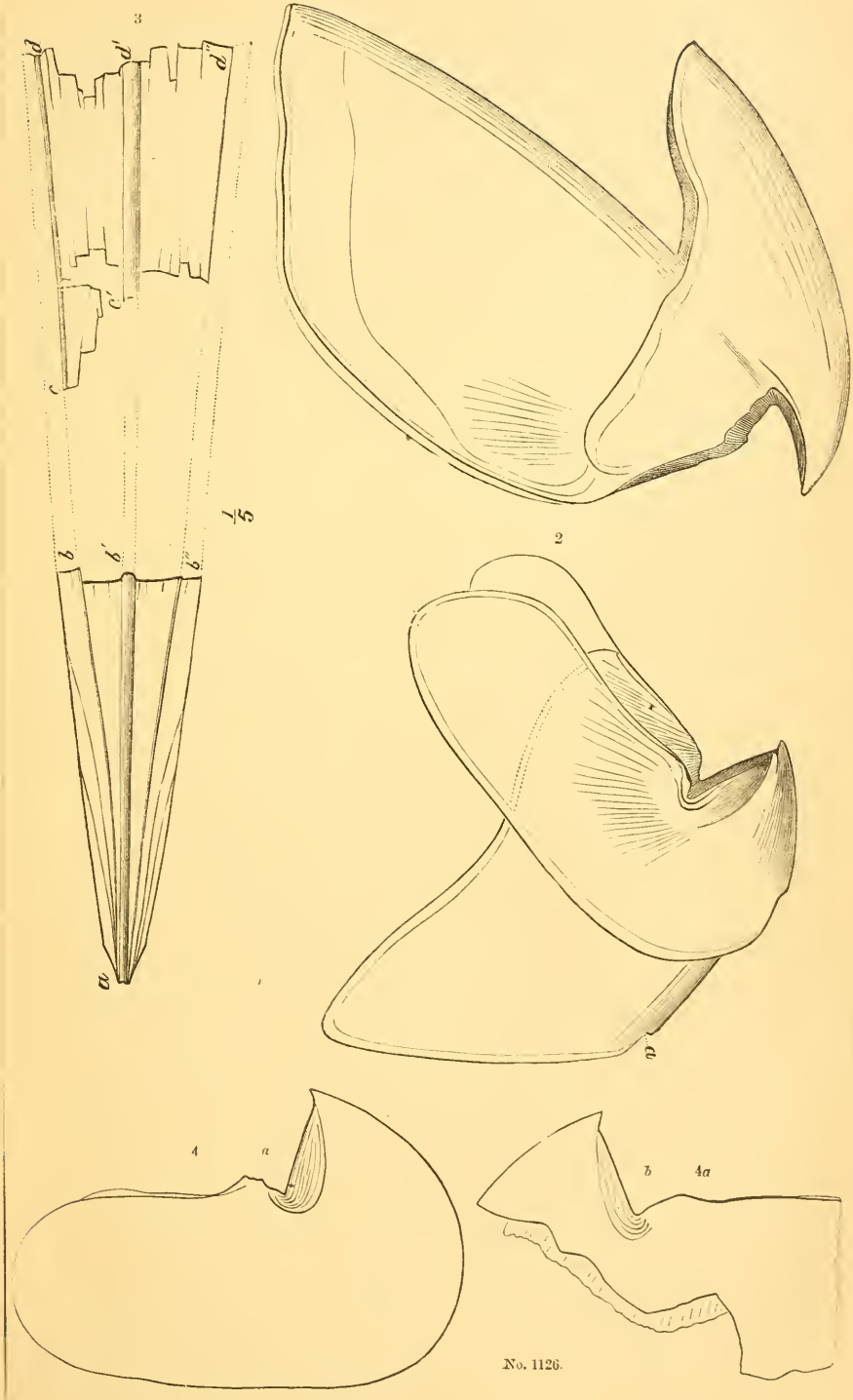

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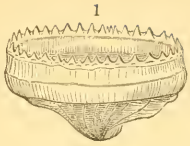

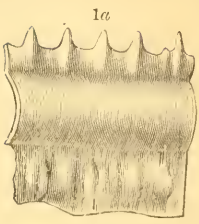

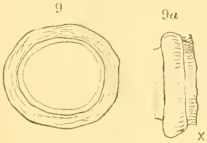

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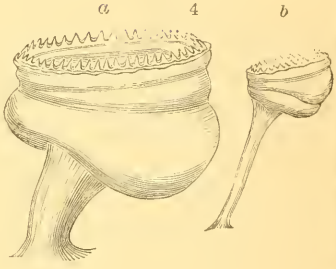

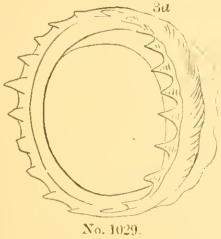

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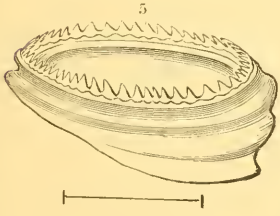

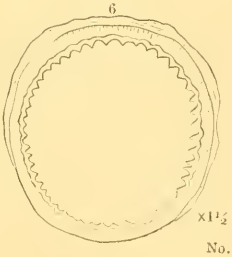

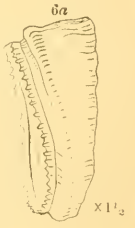

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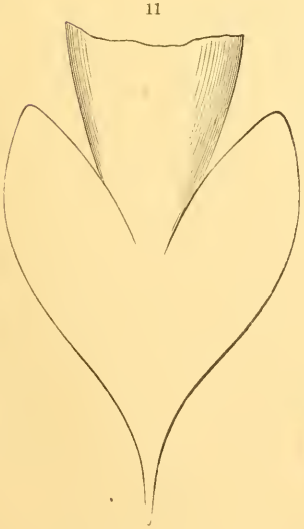

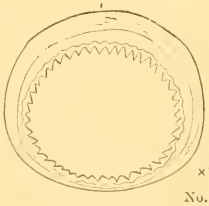

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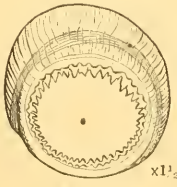

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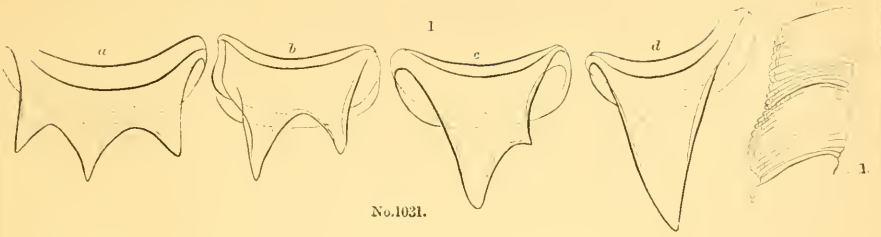

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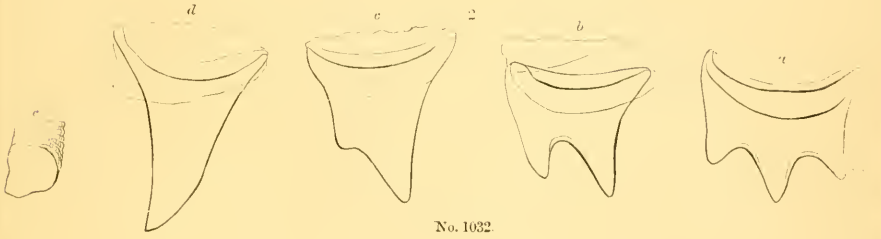

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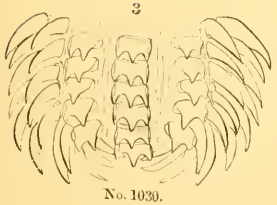

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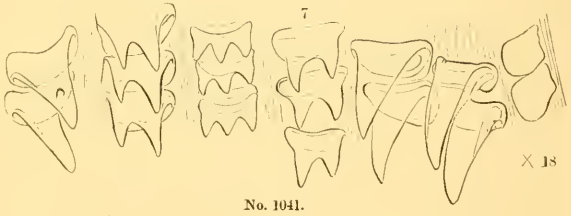

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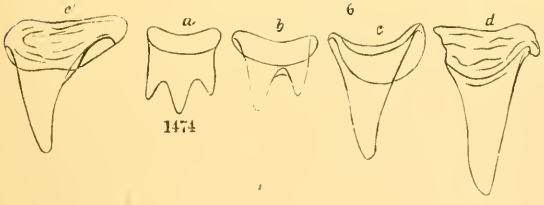

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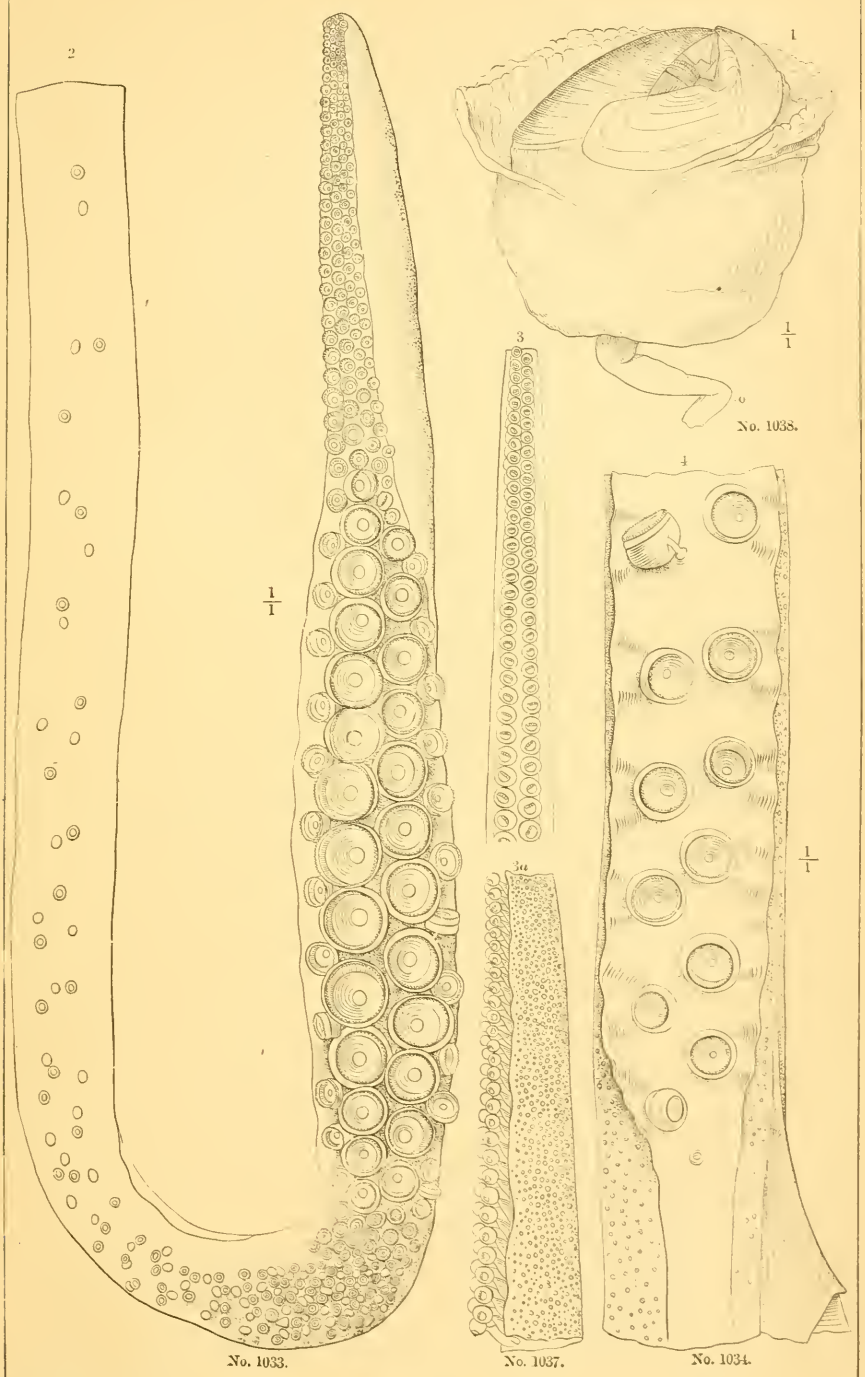

J. H. EMERTON FROM NATURE. AM. P. NORTHRUP & CO., BUFFALO, N. Y.

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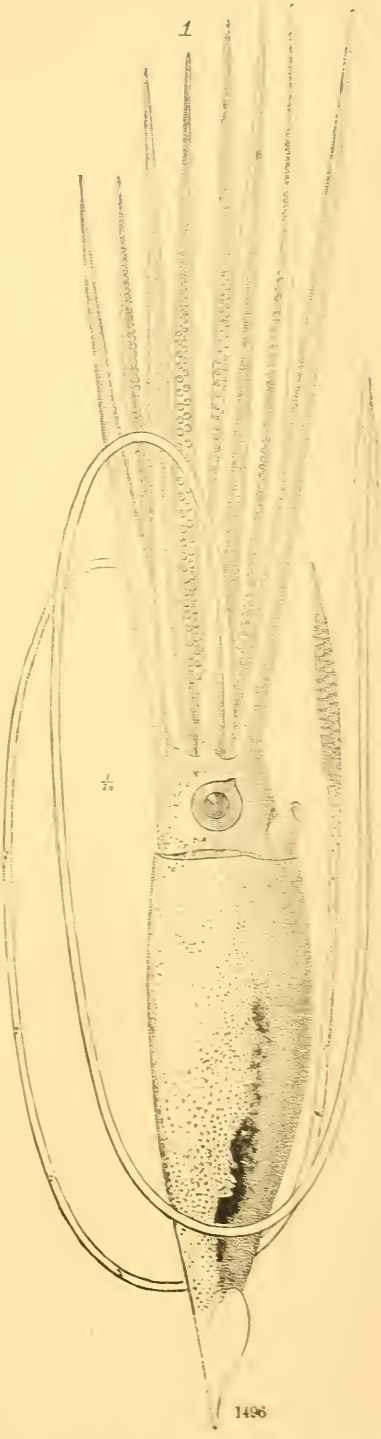
1494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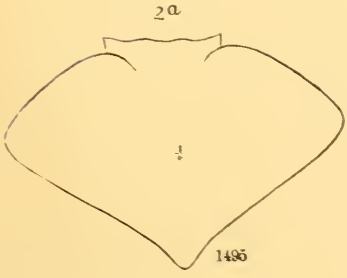
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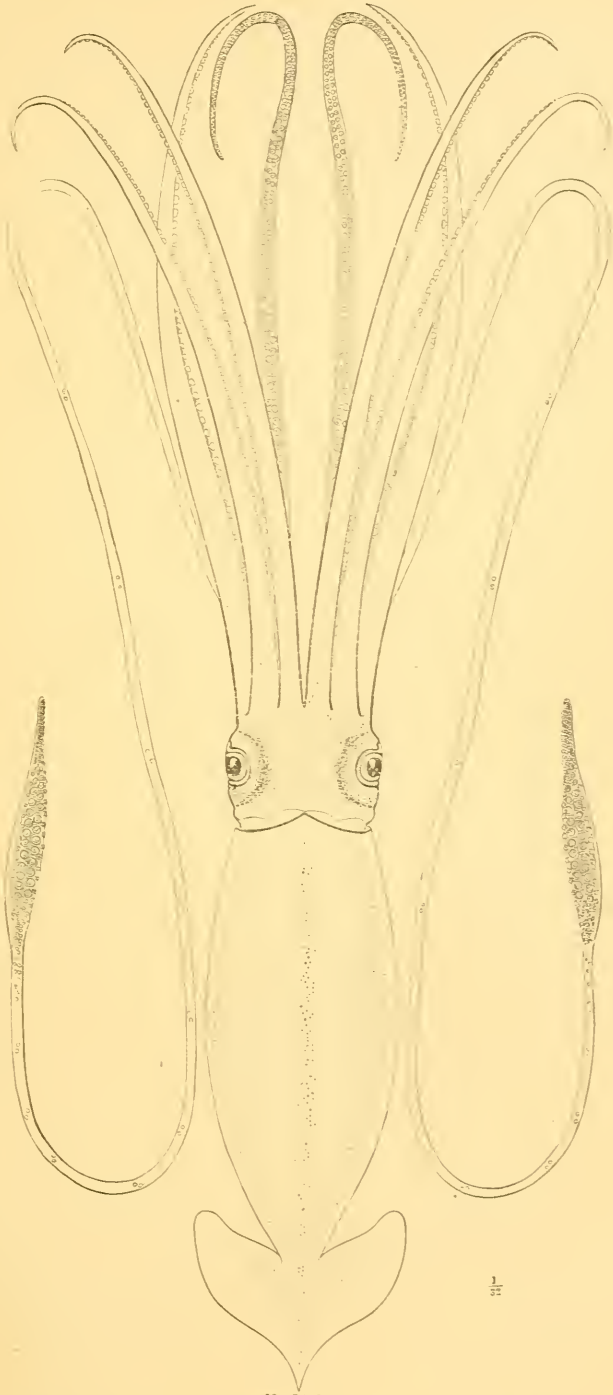

No. 1043.

A. E. VERRILL, FROM NATURE.

WM. P. NORTHRUP & CO. SC., BUFFALO N. Y.

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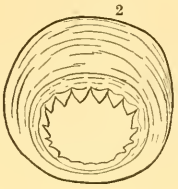

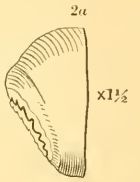

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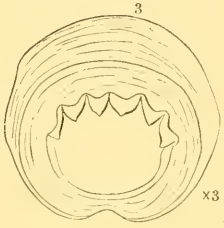

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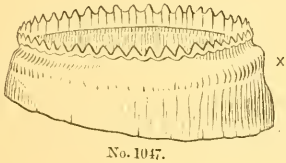

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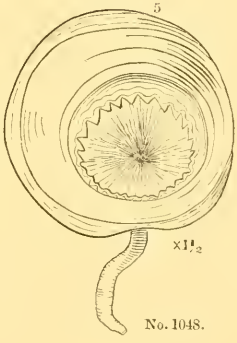

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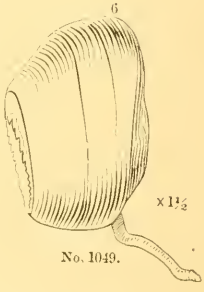

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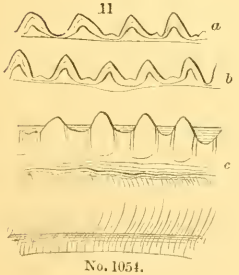

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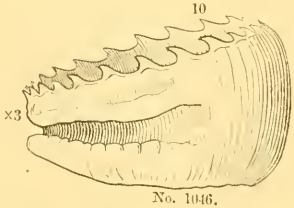

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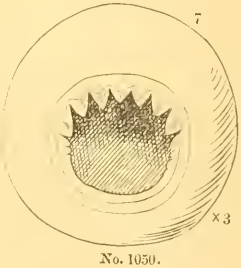

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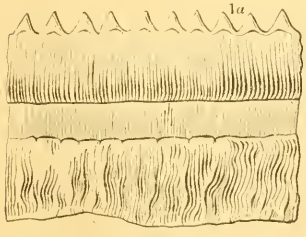

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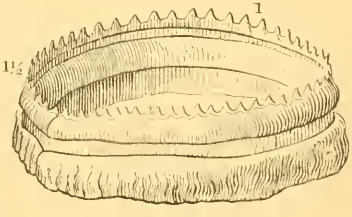

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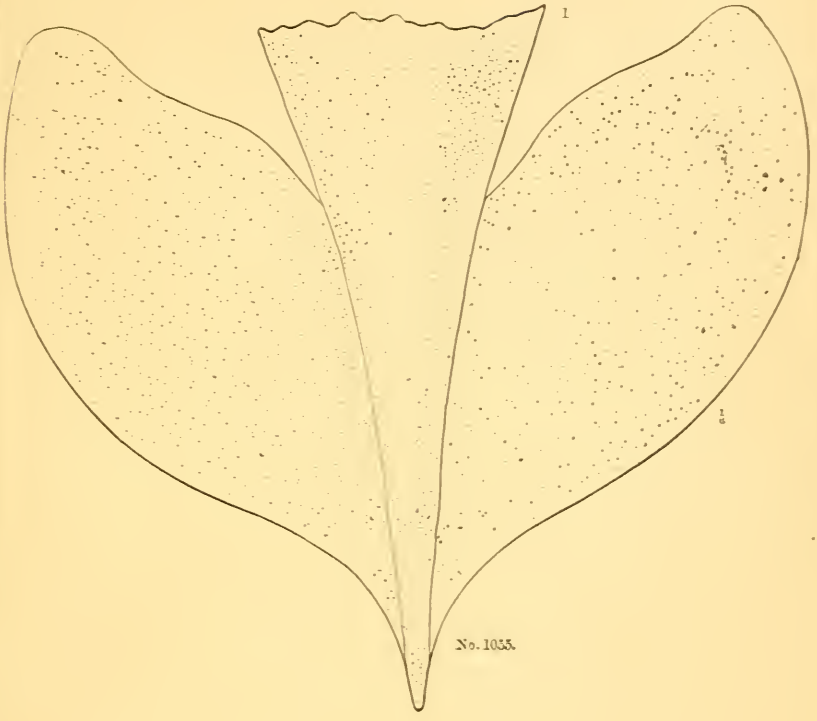
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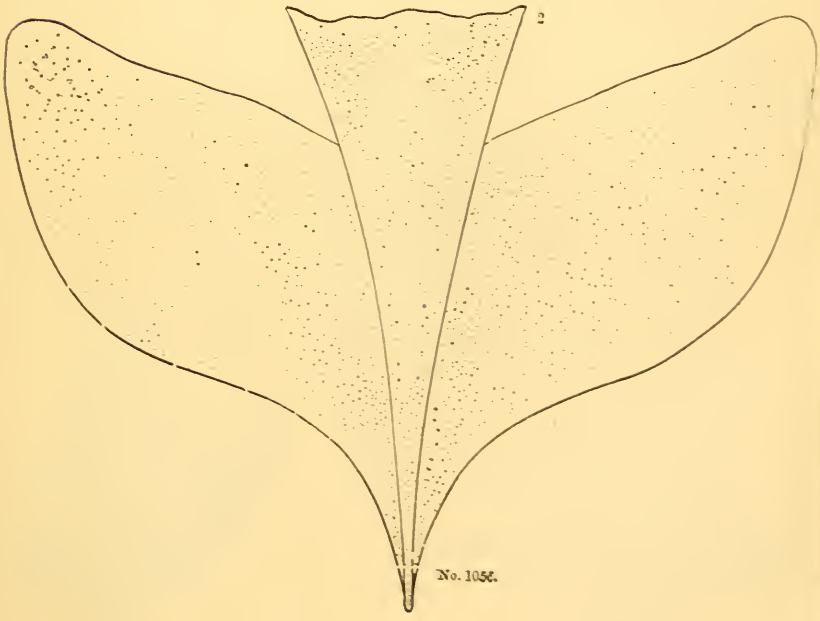
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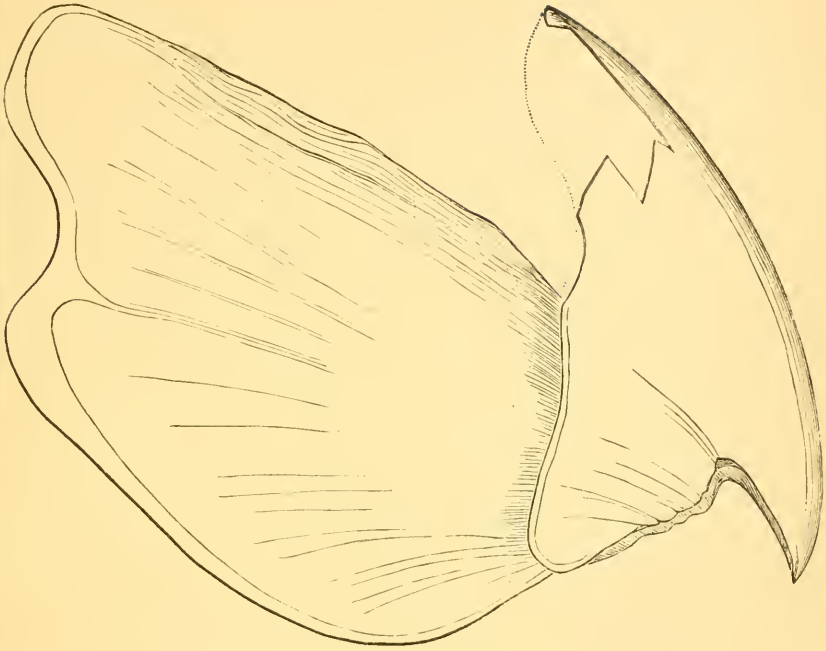

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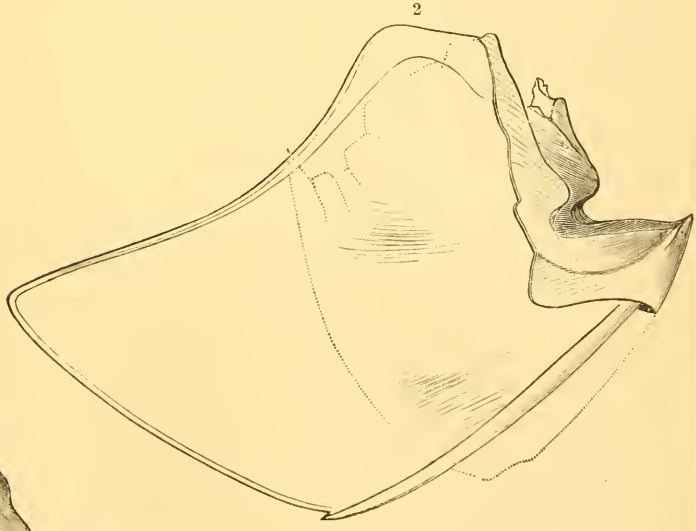

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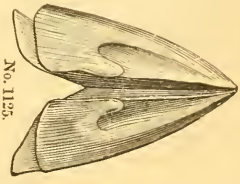

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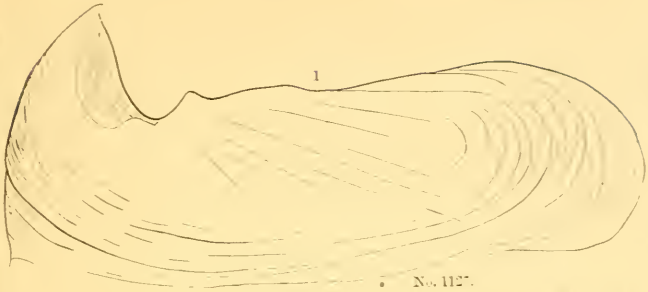
PLATE XII.



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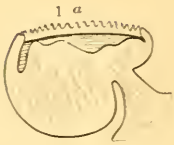

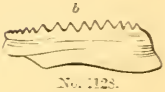

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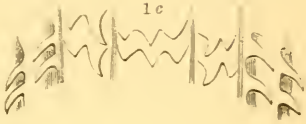

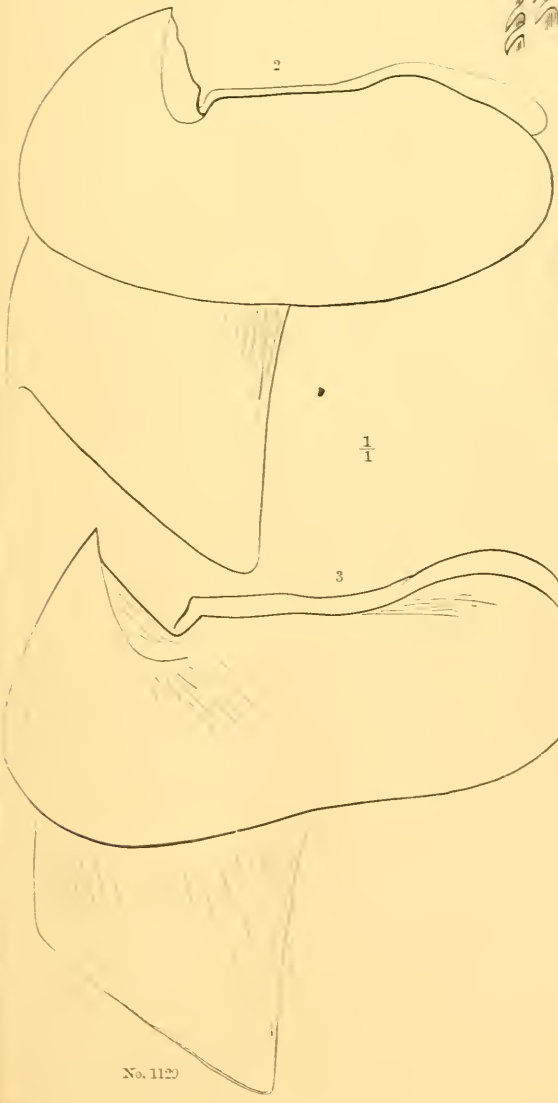

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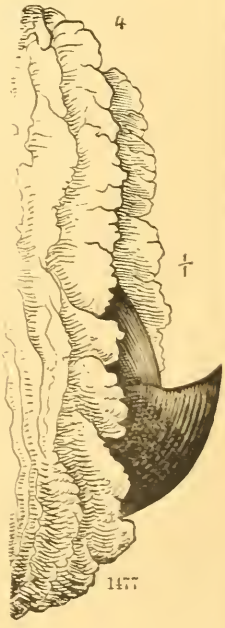
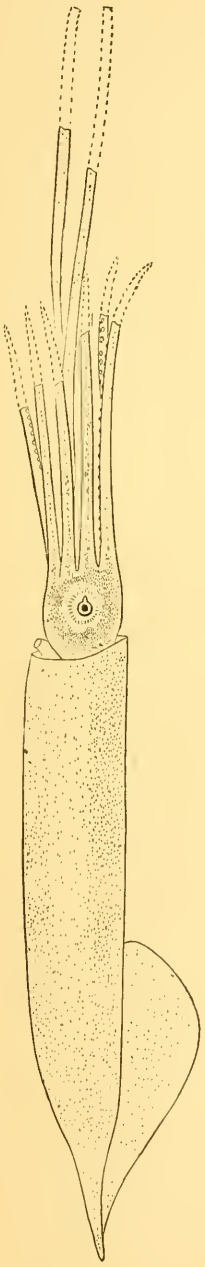
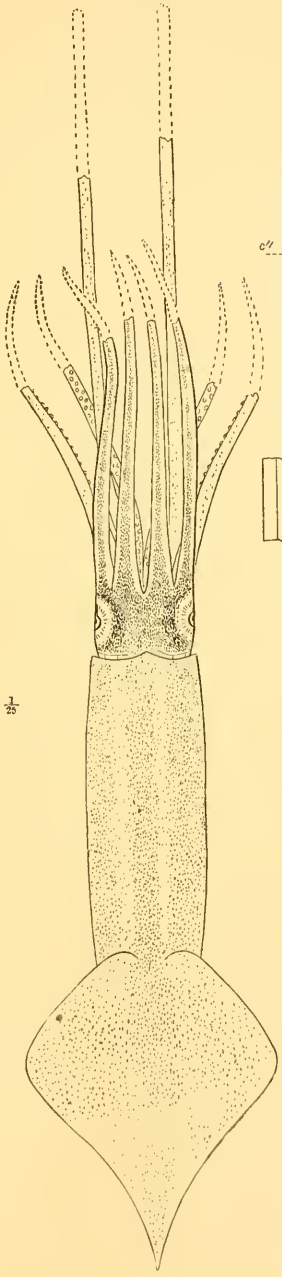
1476

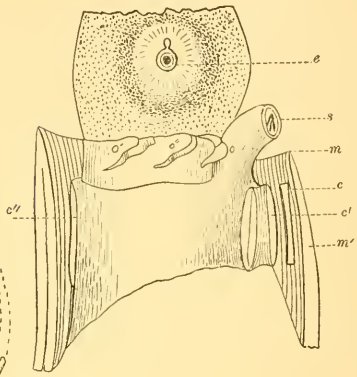


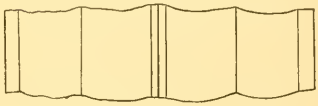
1477

PLATE XIII.









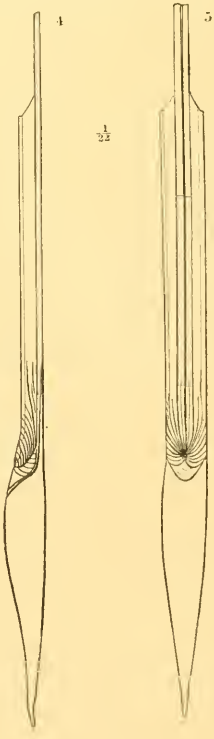


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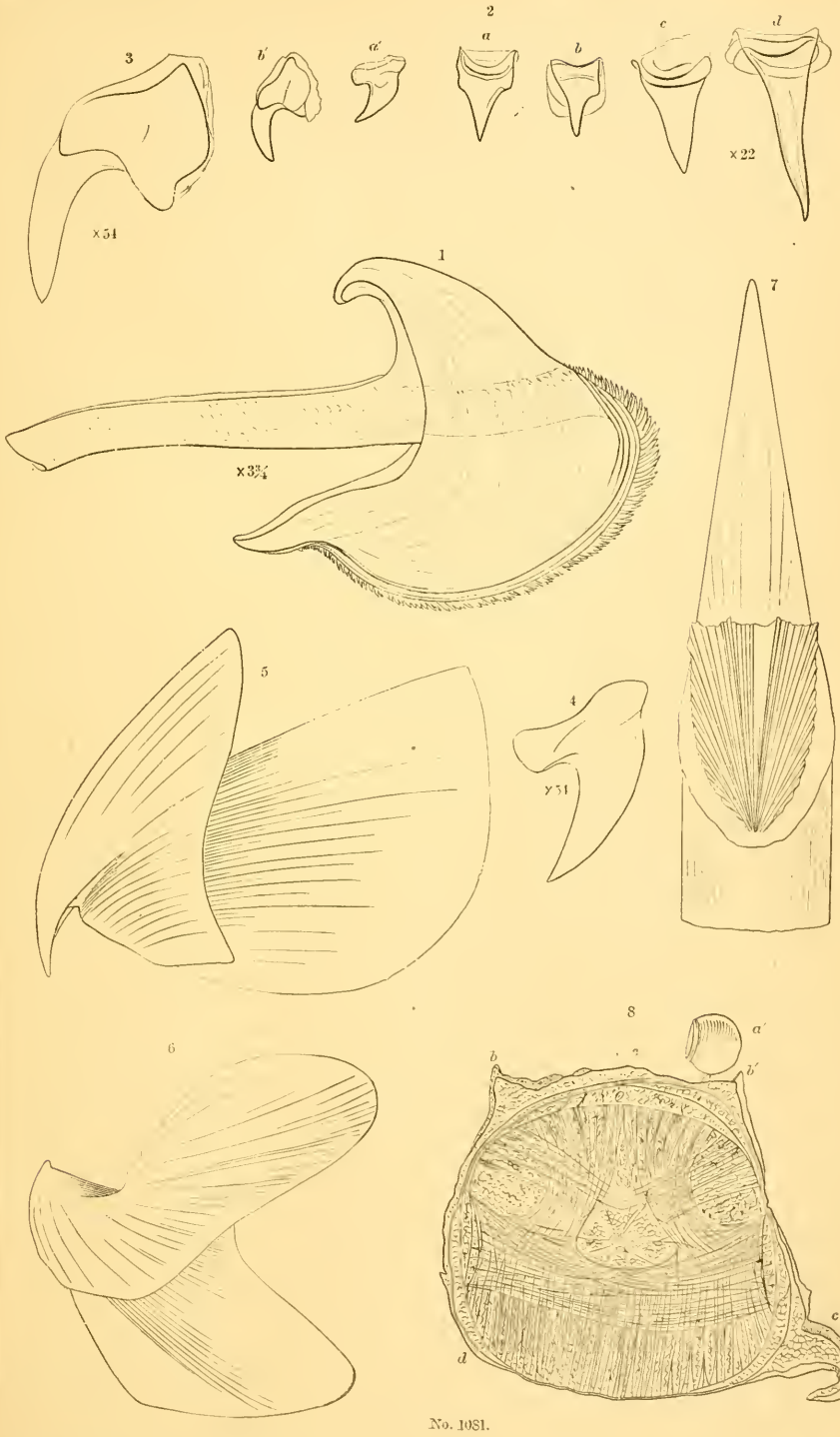
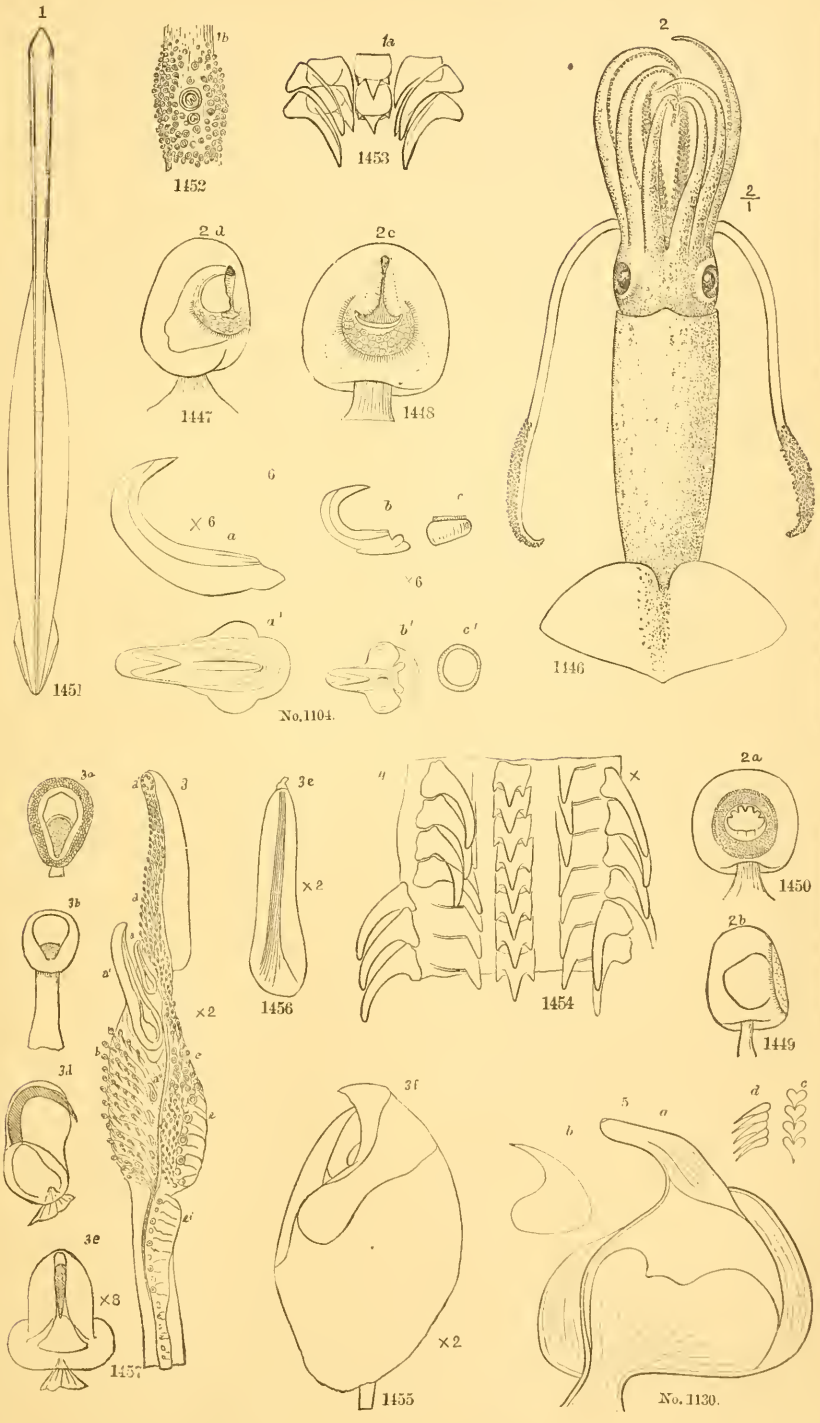
PLATE XIV.



No. 1081.

J. H. Emerton & A. E. Verrill, from nature.

Wm. P. Northrup & Co., Engravers, Buffalo, N. Y.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b
c
×6
a'
b'
c'
No. 1104.
3a
3b
3d
3e
×8
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d
a'
×2
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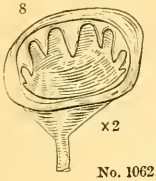

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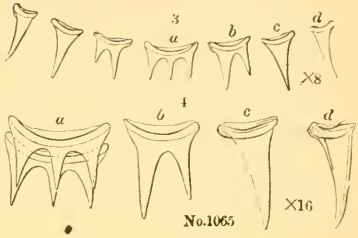

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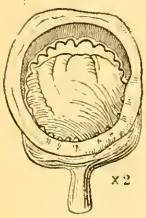

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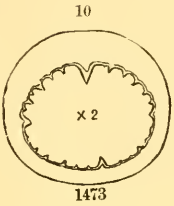

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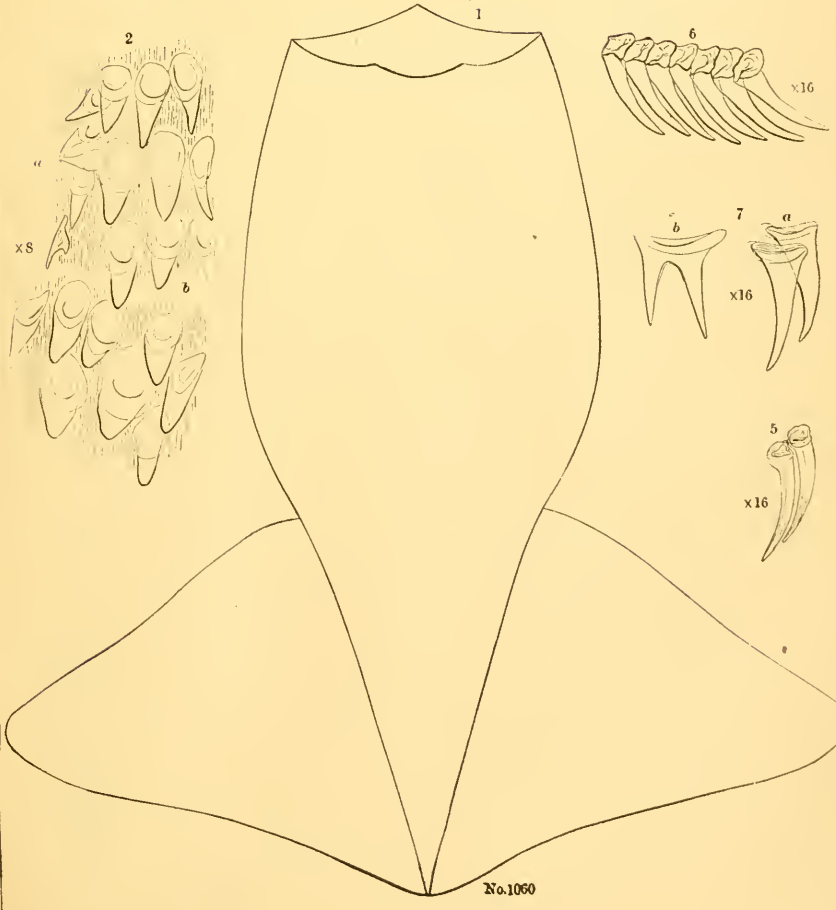

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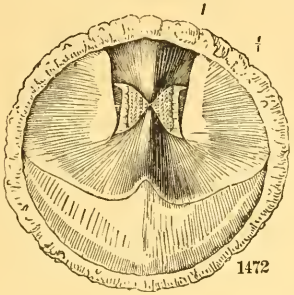
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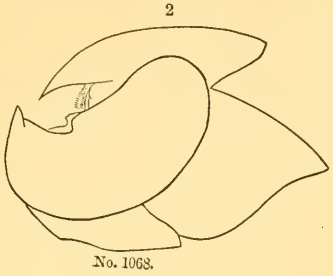
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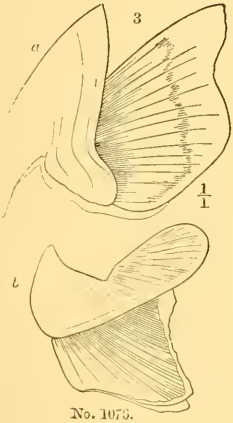
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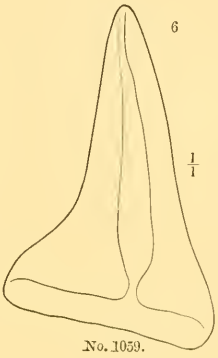
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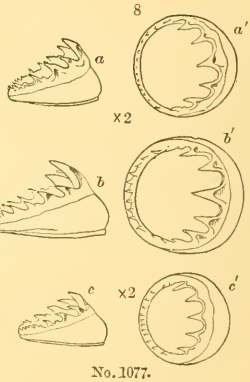
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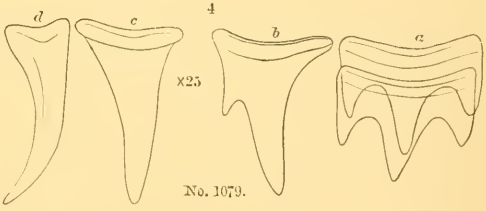
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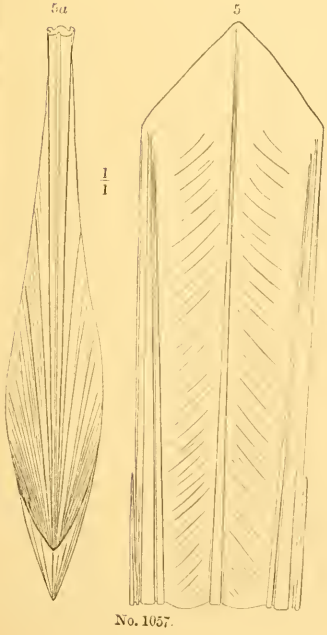
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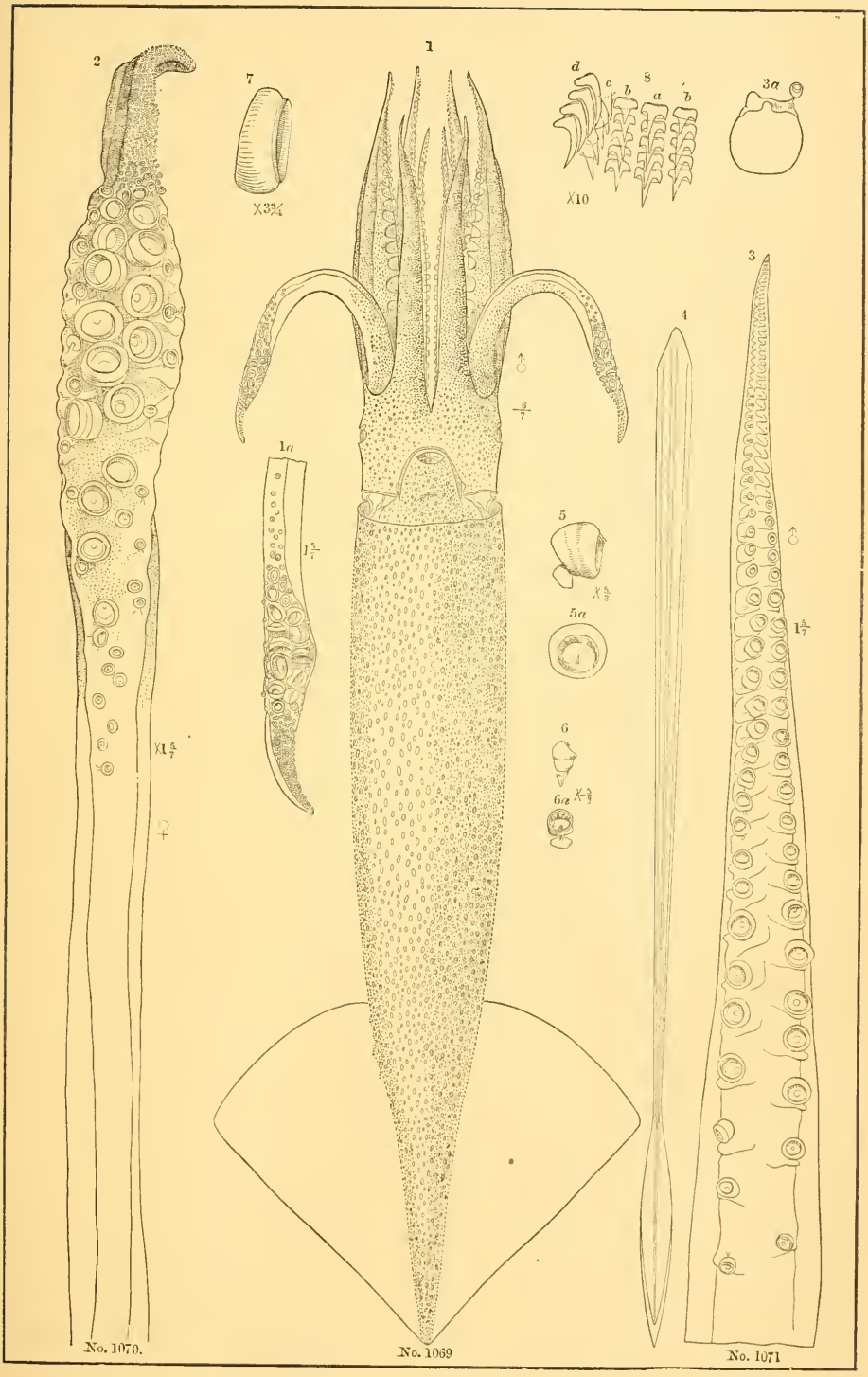
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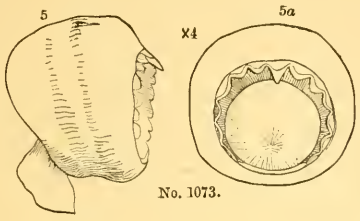
No. 1069
No. 1071



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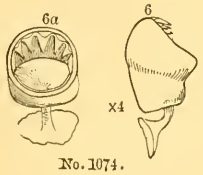

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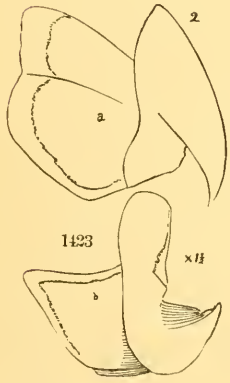

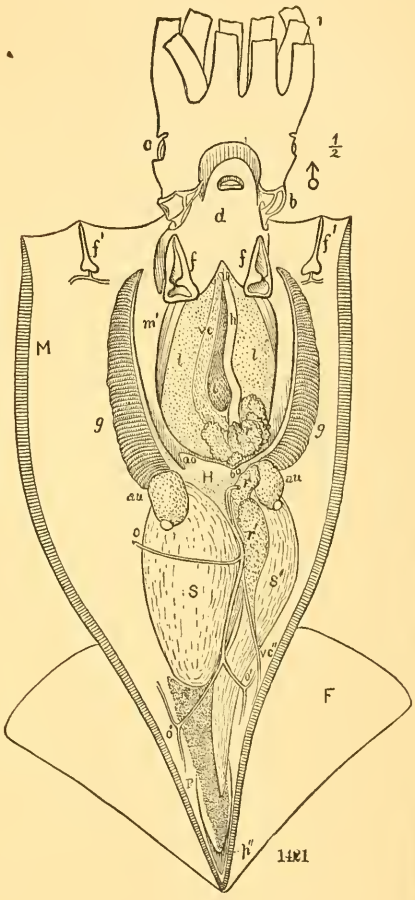

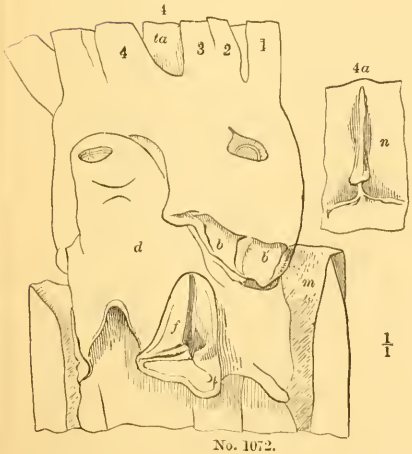

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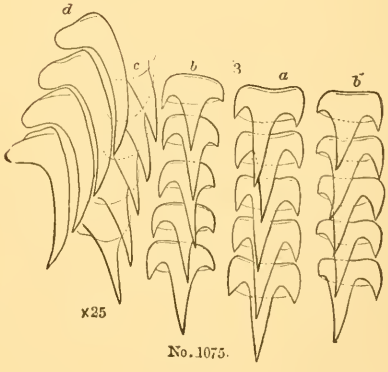

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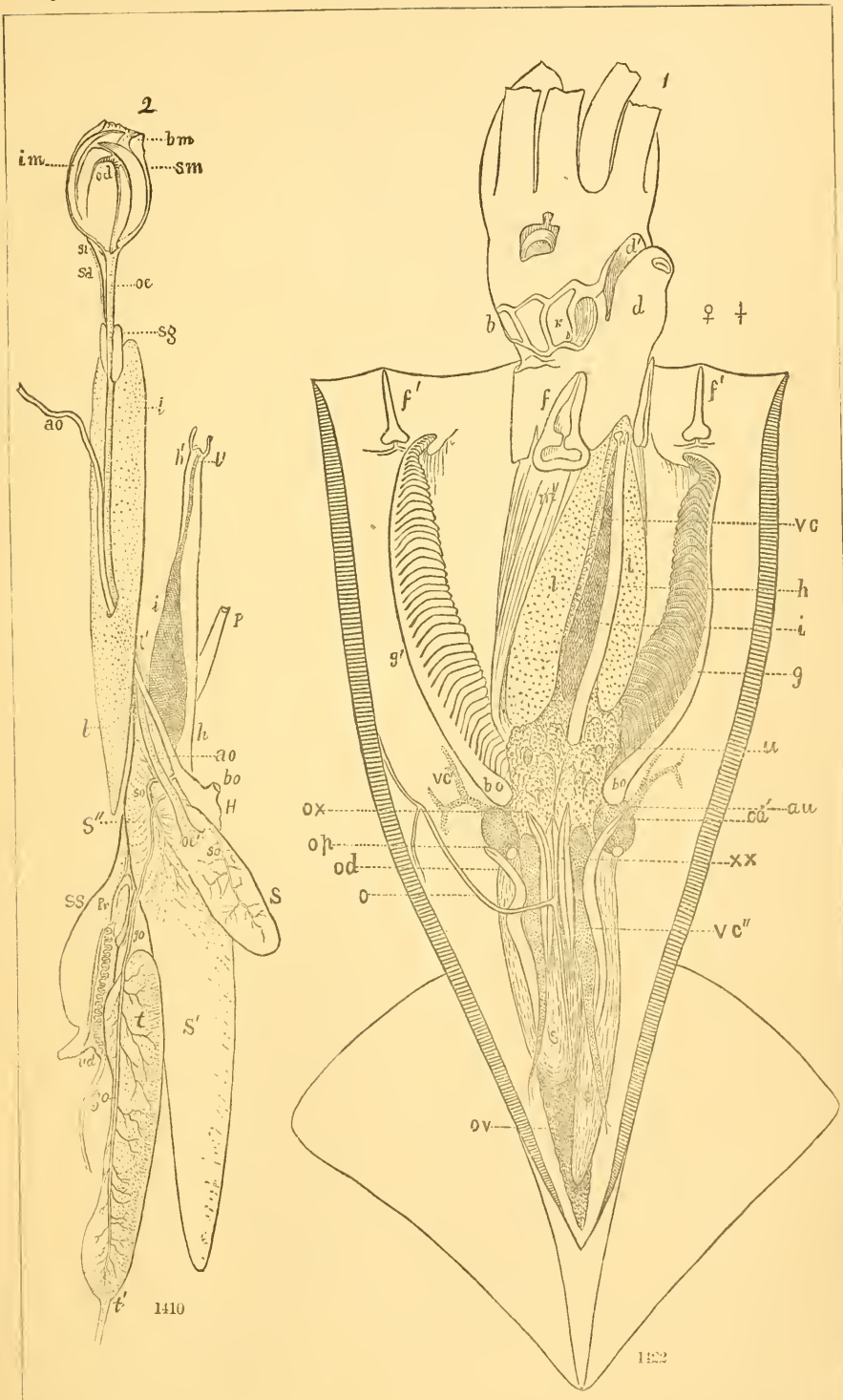
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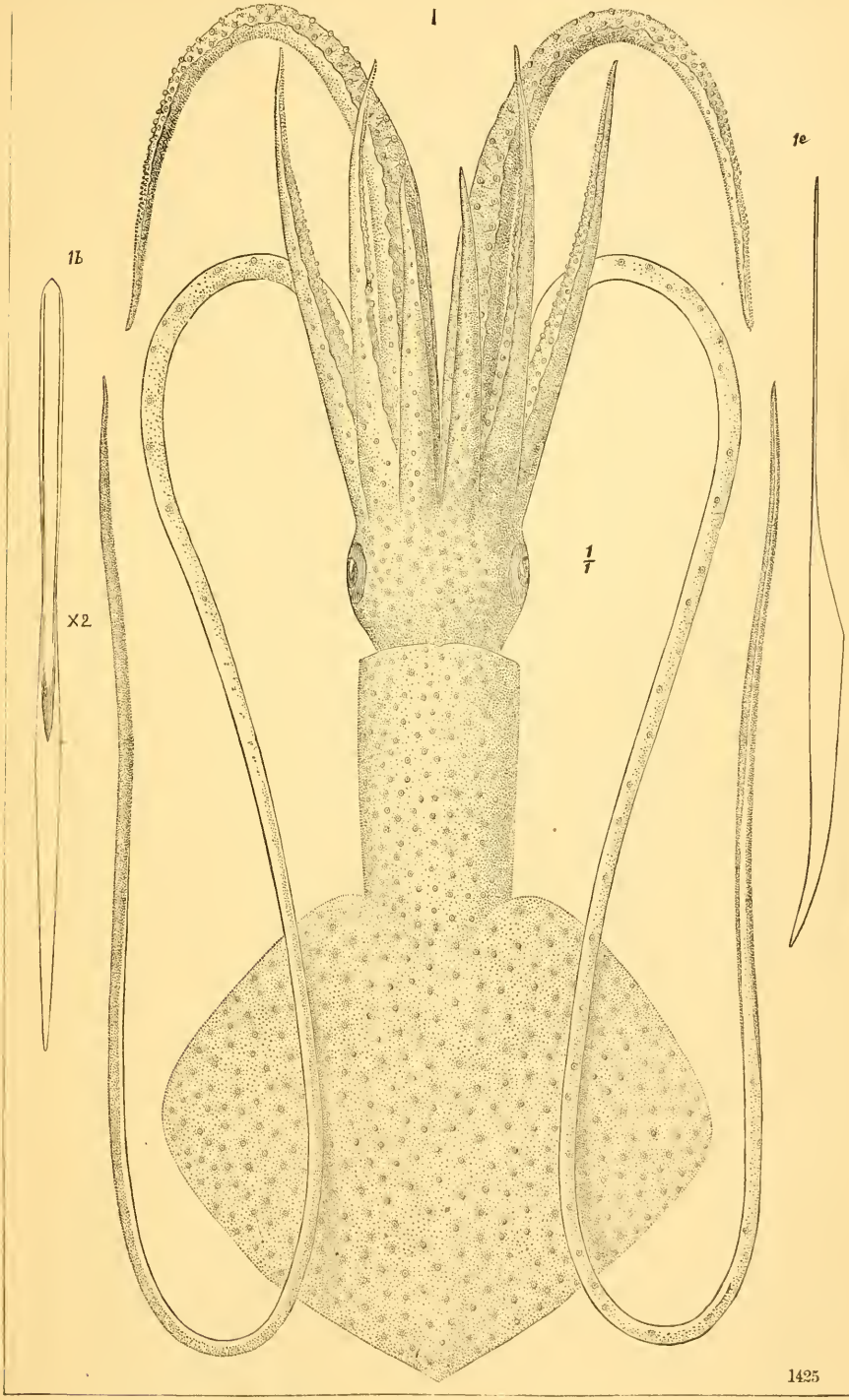
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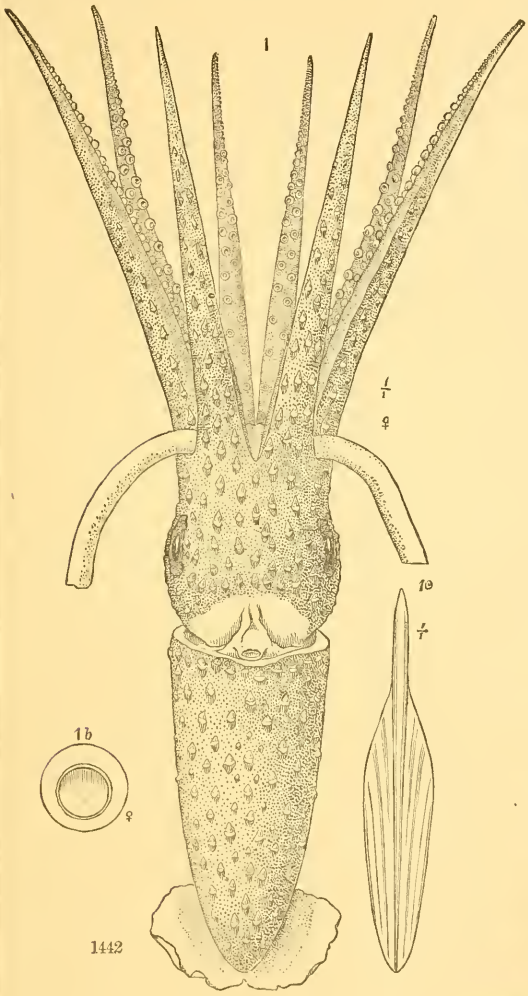
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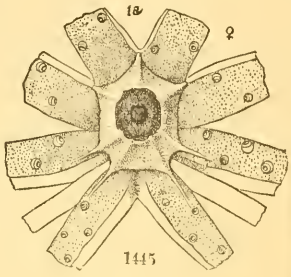
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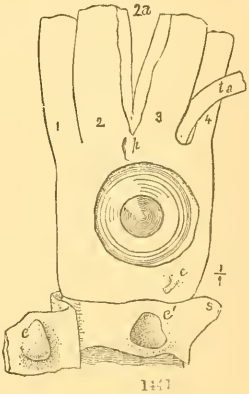
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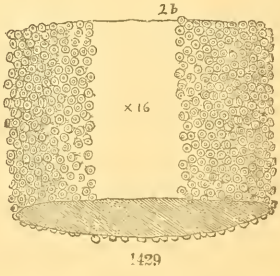
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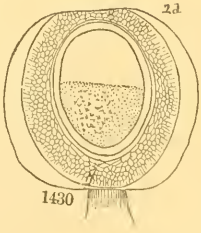
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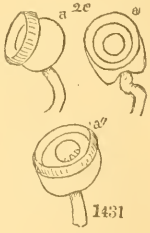
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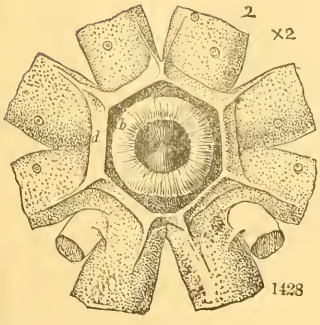
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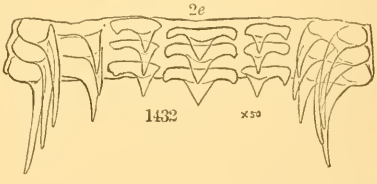
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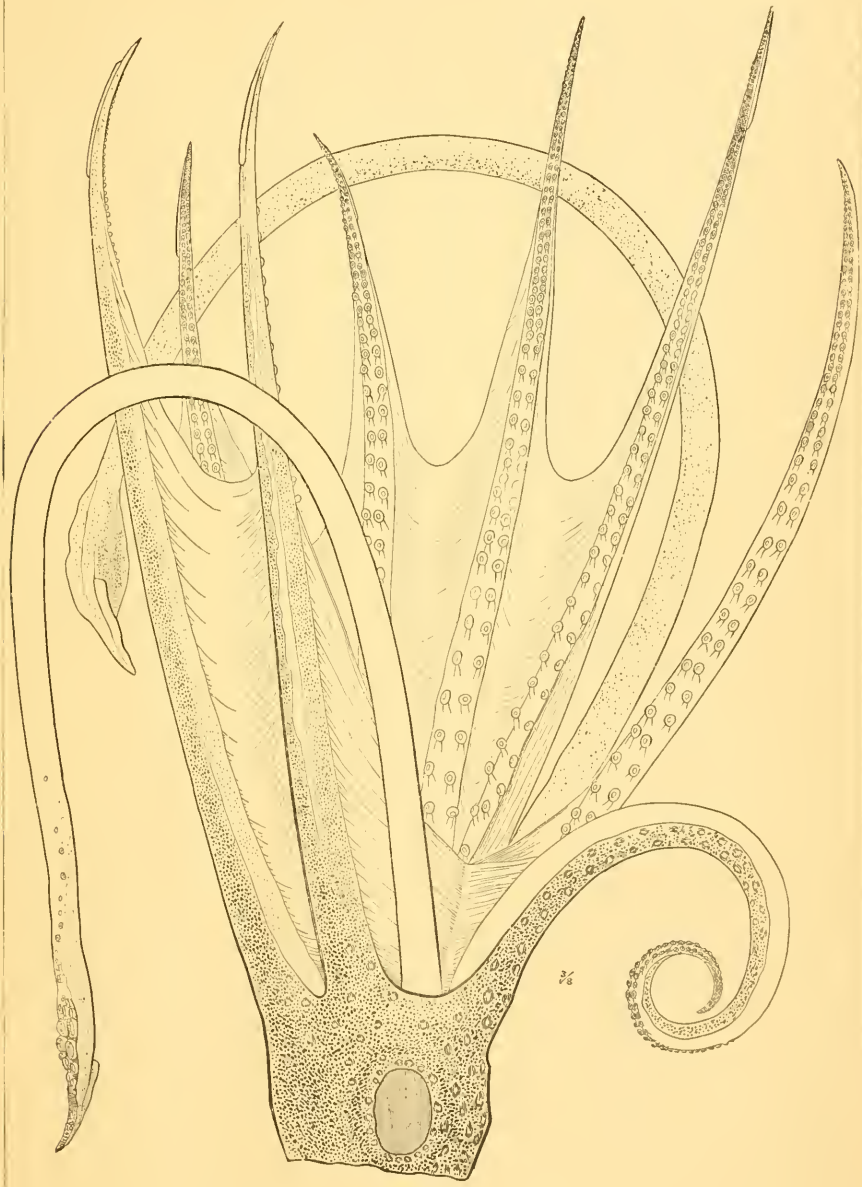

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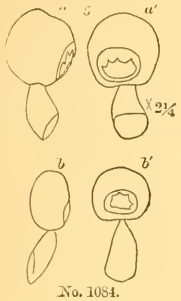

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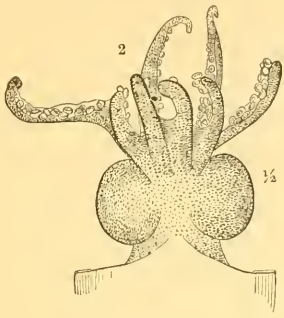

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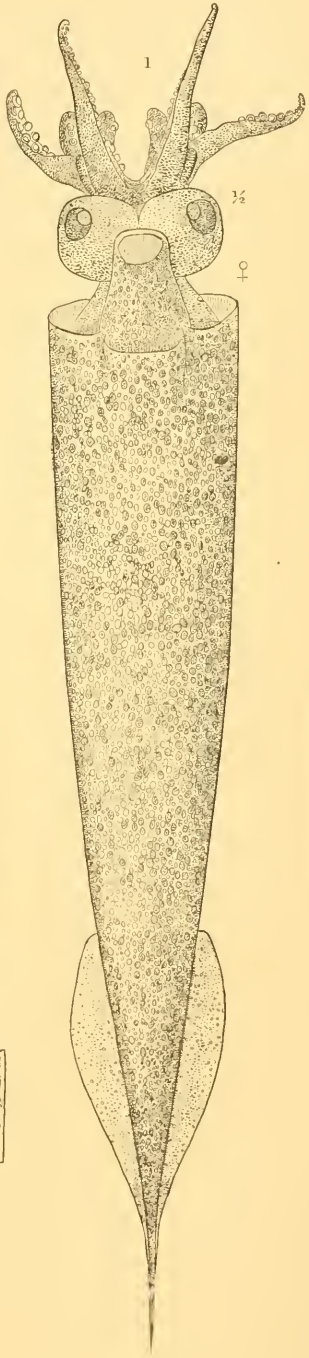

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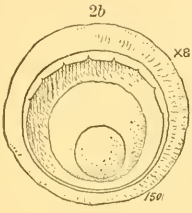

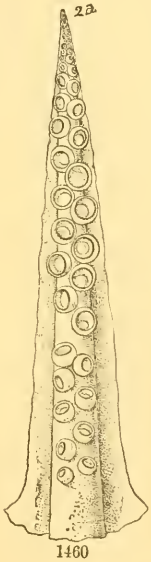

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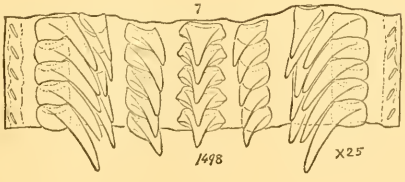

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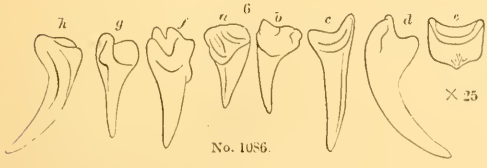

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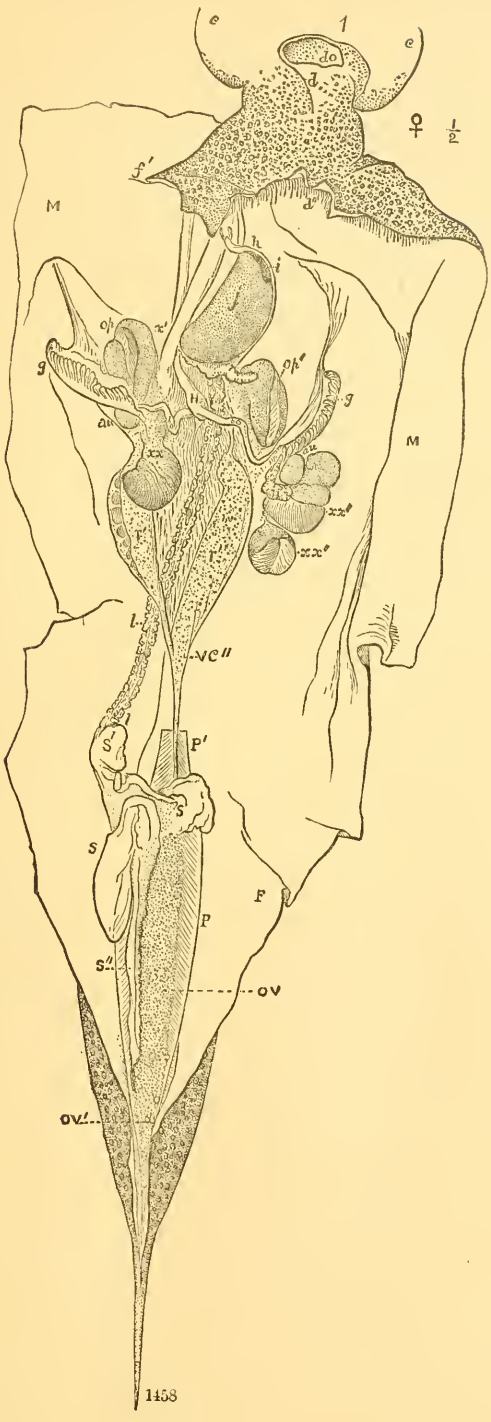
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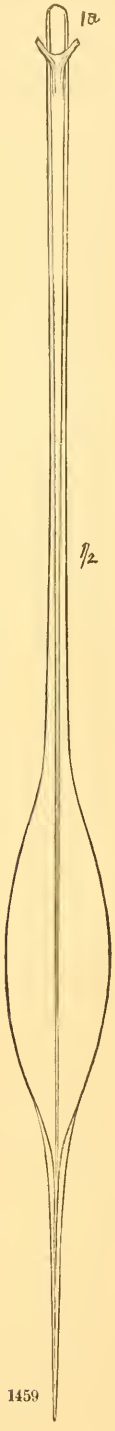
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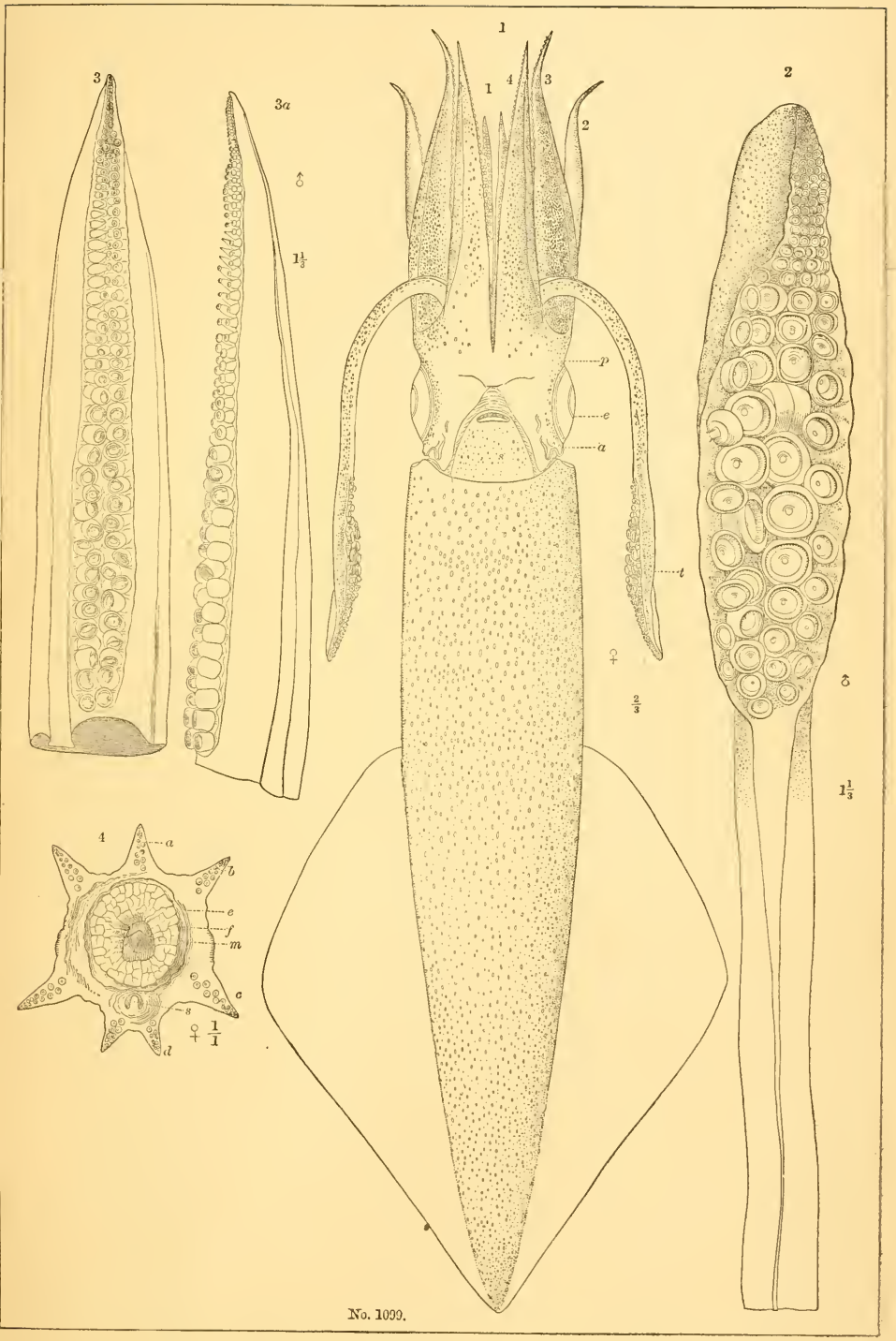
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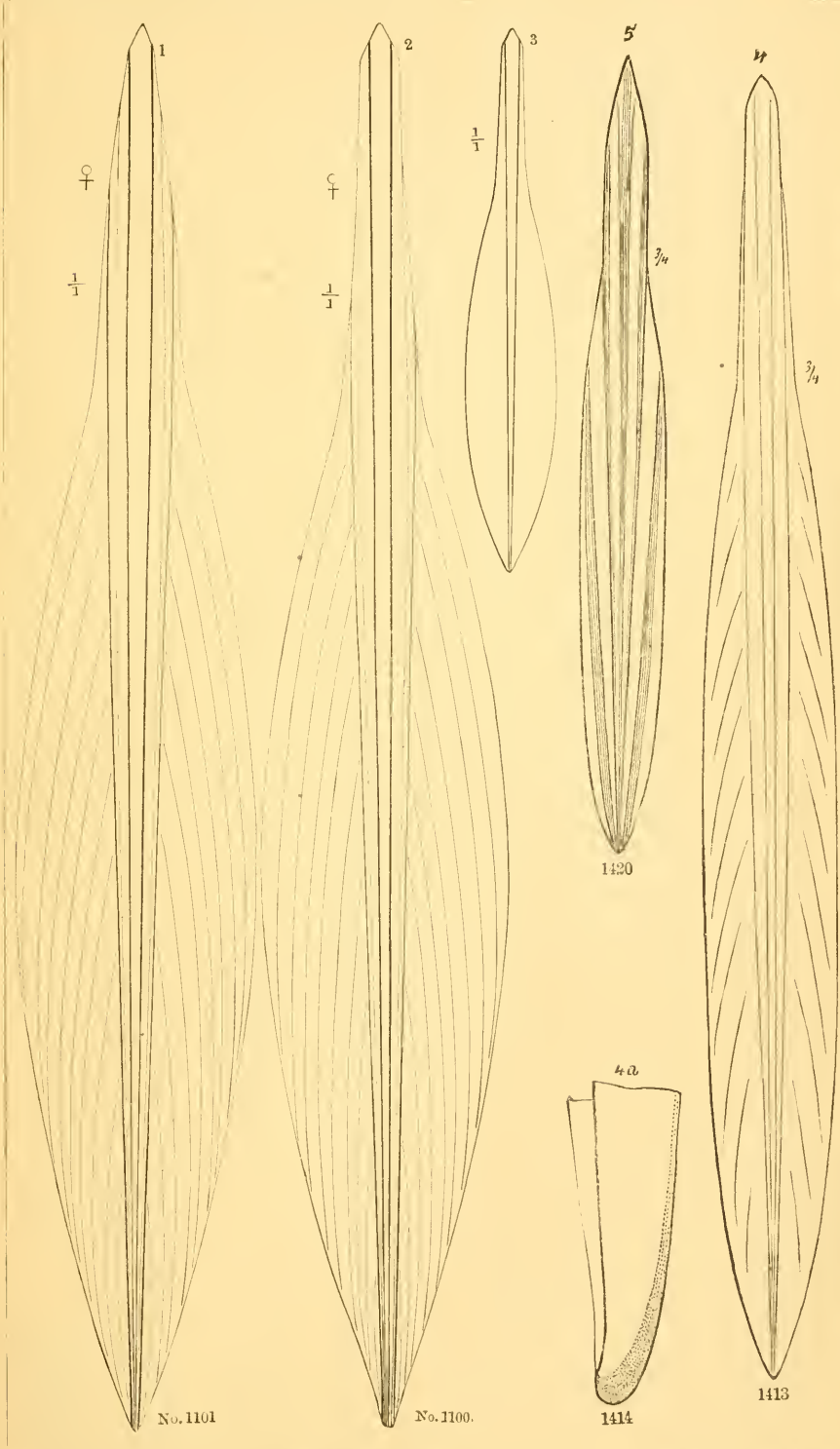
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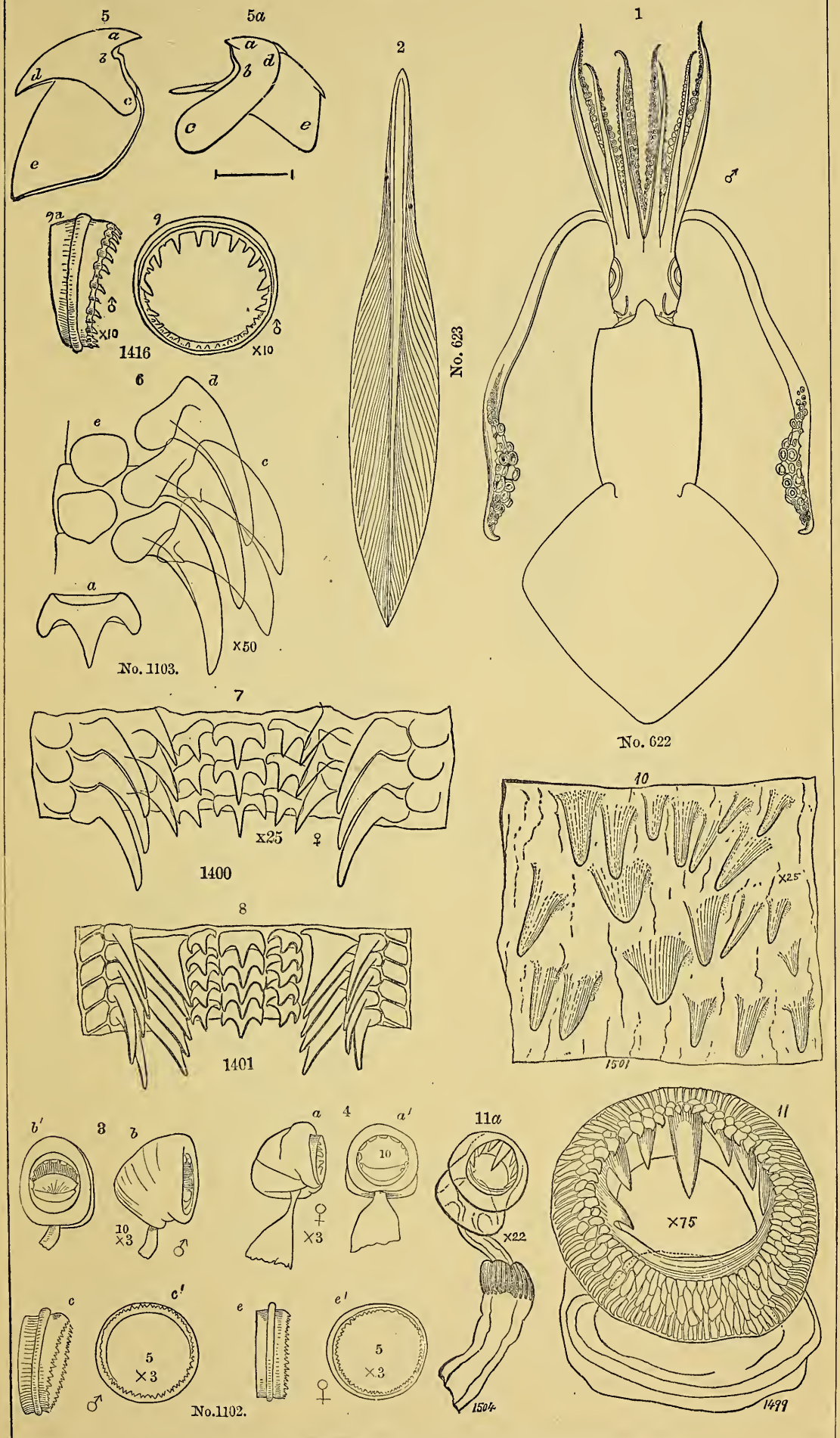
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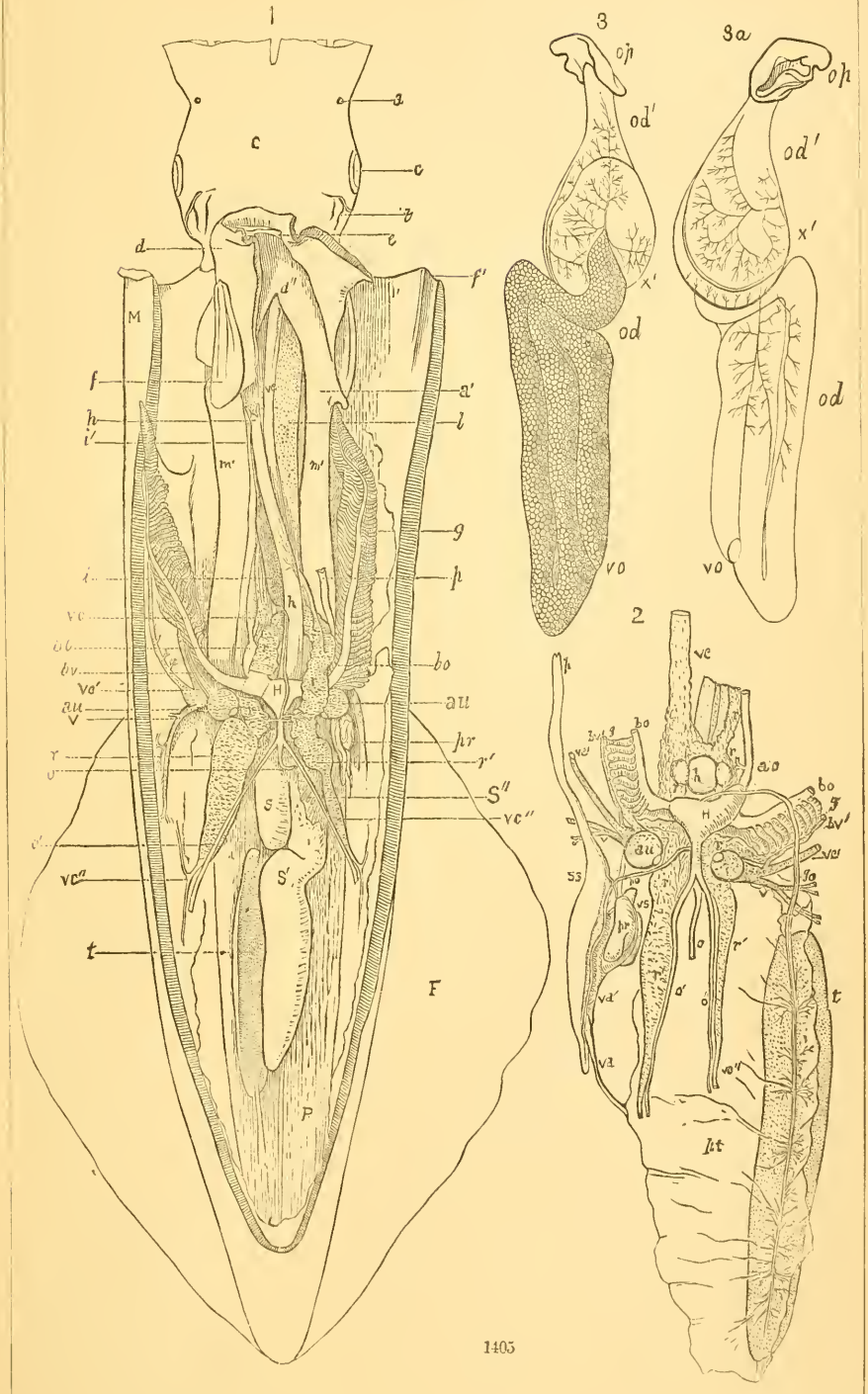
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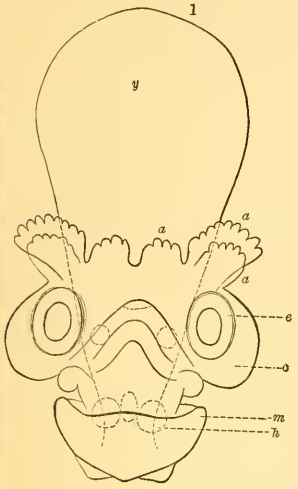

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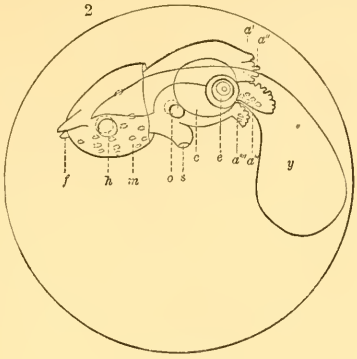

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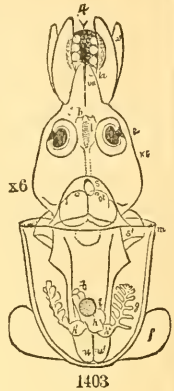

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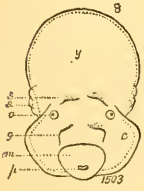

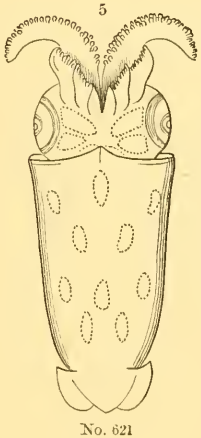

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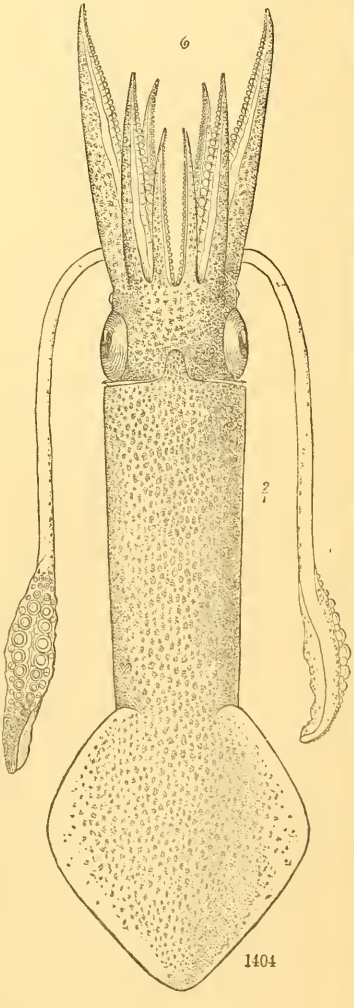

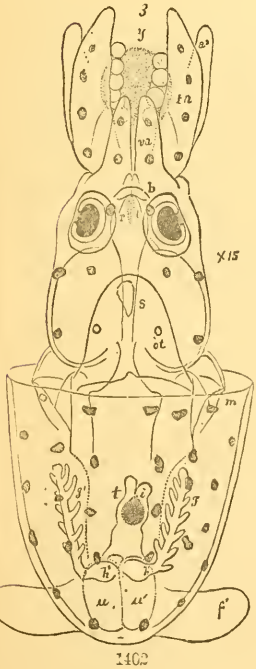

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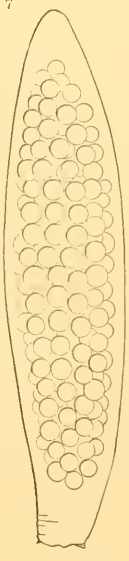

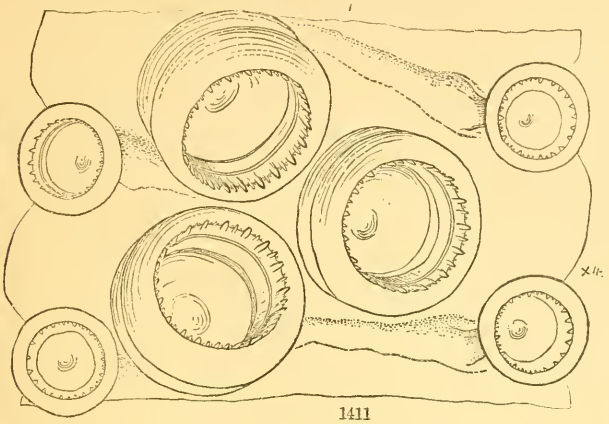

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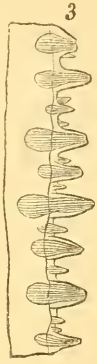

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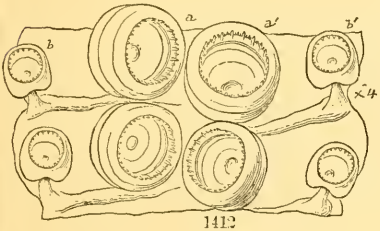

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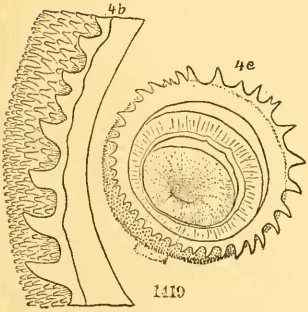

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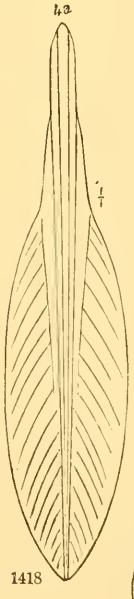

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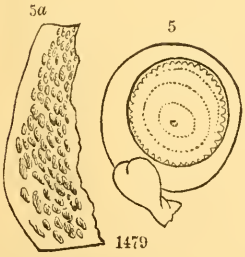
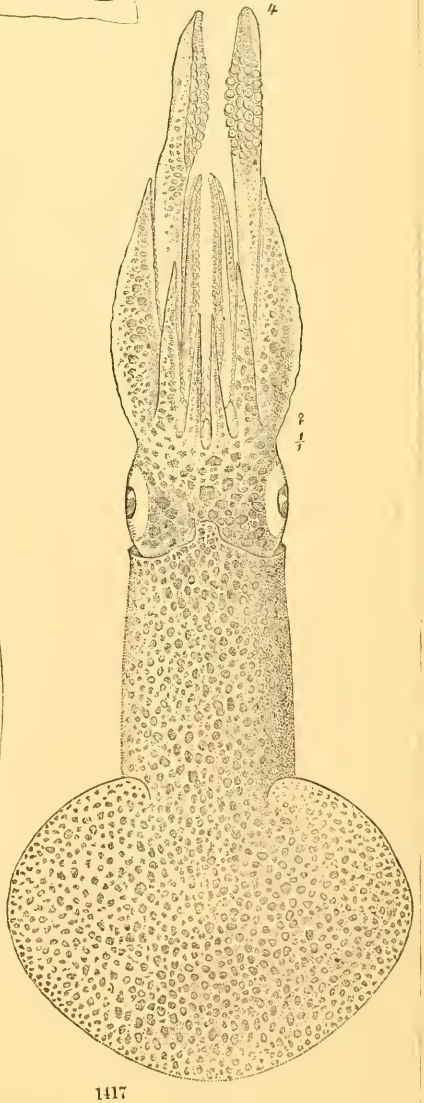


1479



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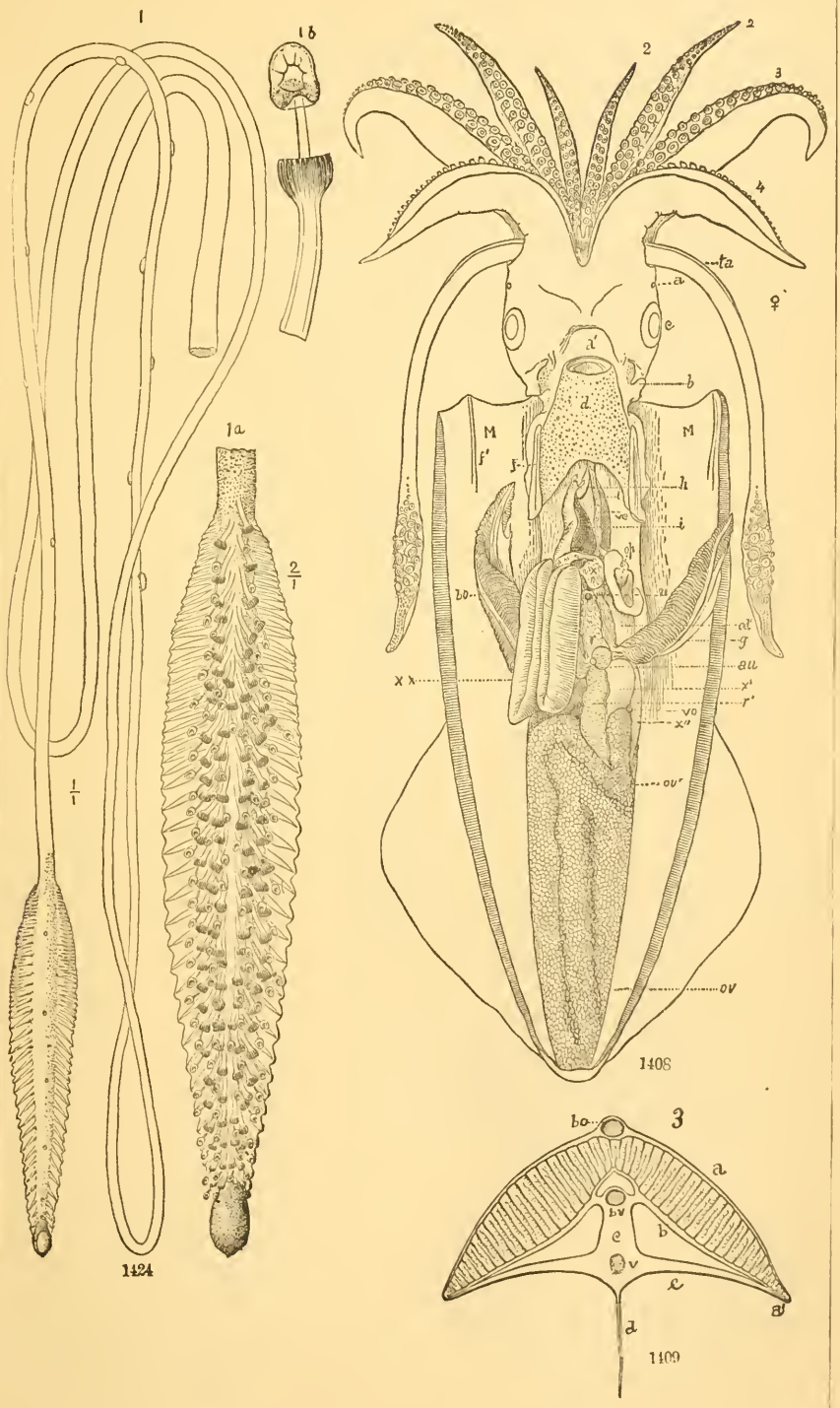
1
1b
1a
2/1
1/1
1424
2
2
3
h
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♀
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1408
bo
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bv
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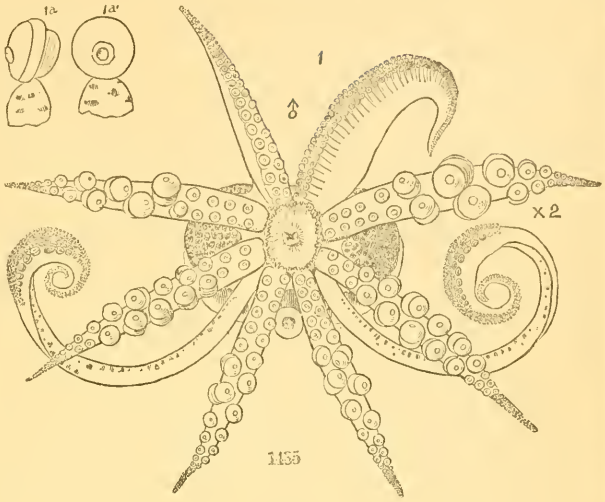
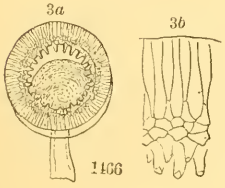
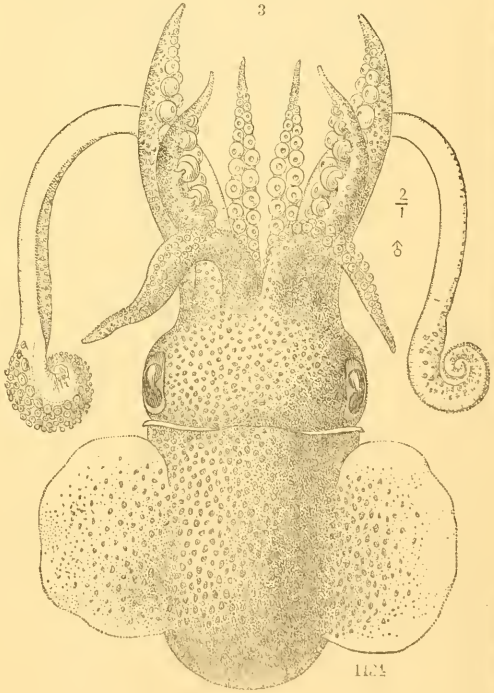
b
v
c
B
d
1409

2a
5/1
1436


1a
1a'
1
♂
X2
1435


3a
3b
1466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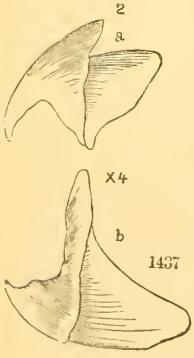
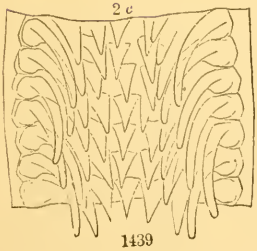
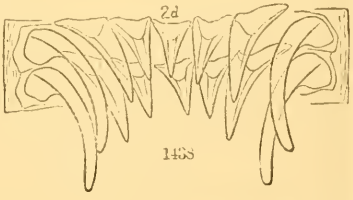
2/1
♂
1434

2 b
X6
1440


2
a
X4
b
1437


2 c
1439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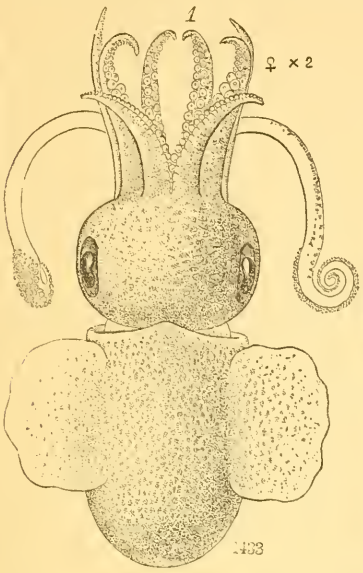
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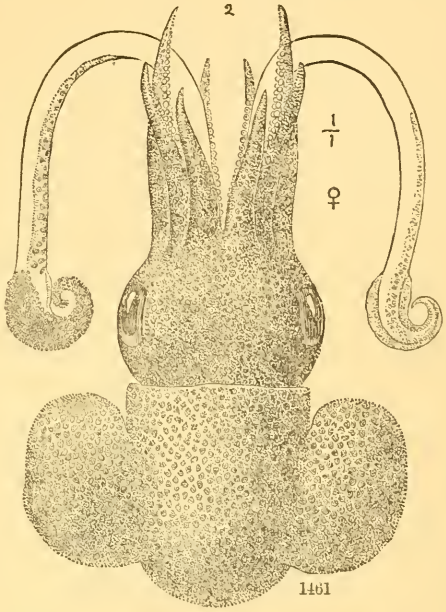
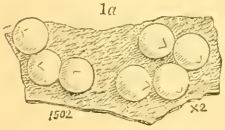
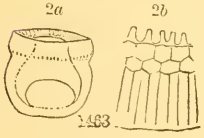
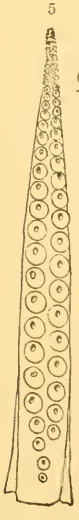

2
1/1
♀
1461


1a
1502
×2


2a
2b
1463

6
♂
1465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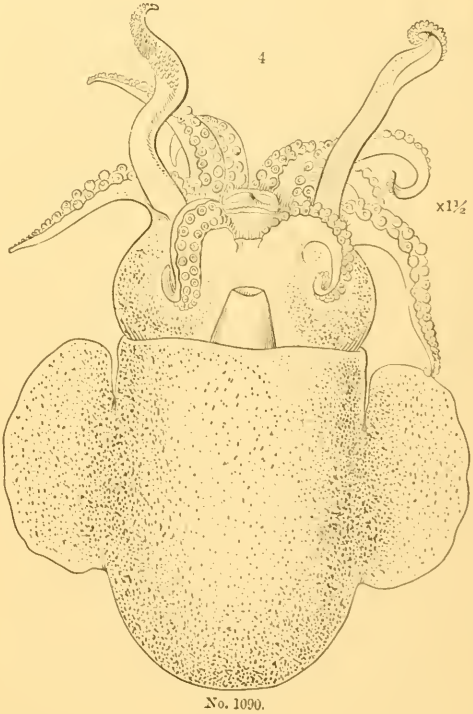
♀
1464

3
×4
1462


4
×1¼
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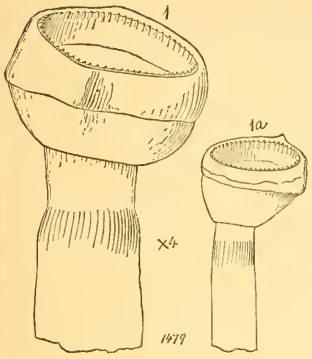
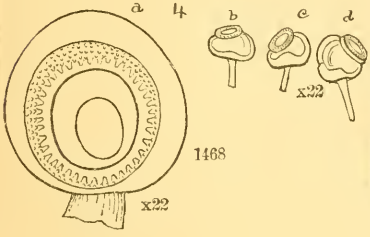
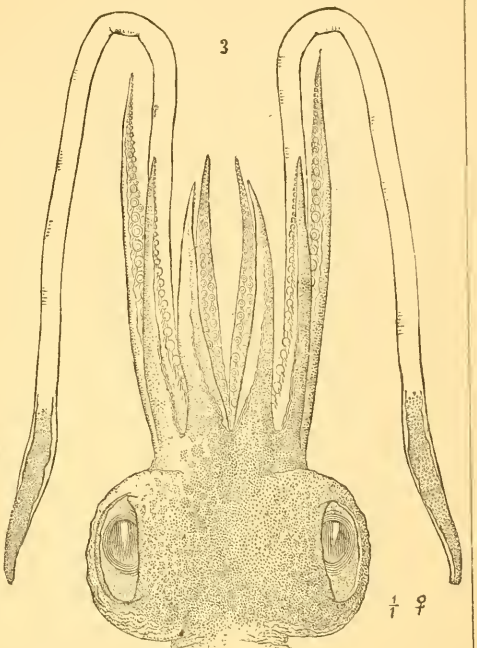

1
1a
×4
1479


a
4
b
c
d
×22
1468
×22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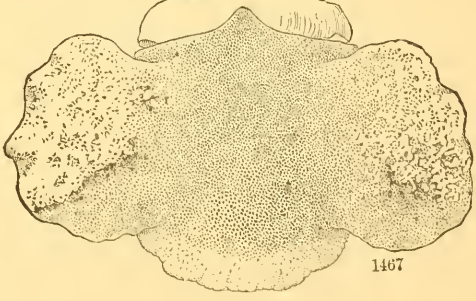
1/1 ♀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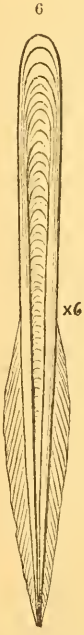
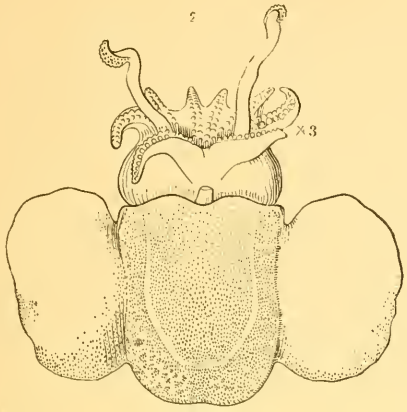

6
×6
1470

2
♀
×1½
No. 1095.

5
×6
No. 1096.



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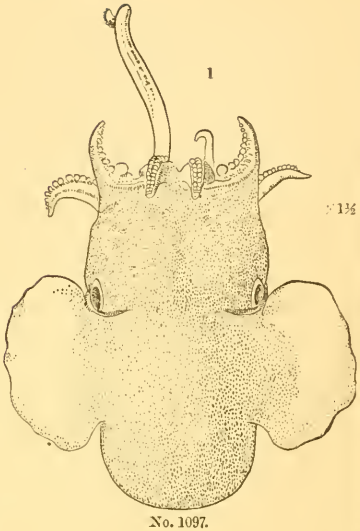

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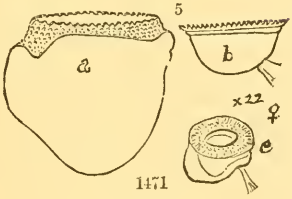
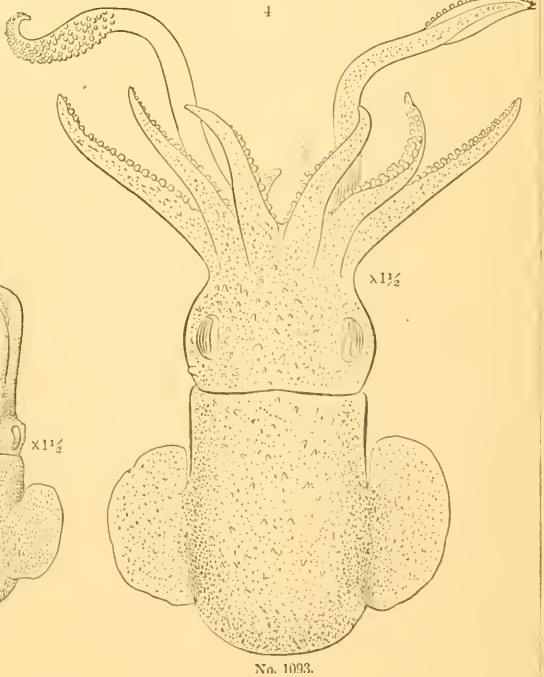


1471



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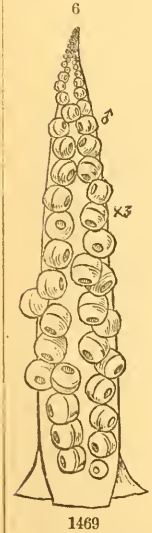

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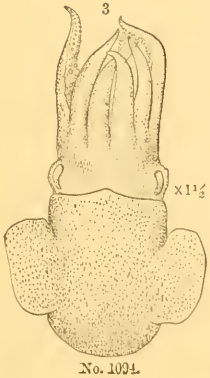

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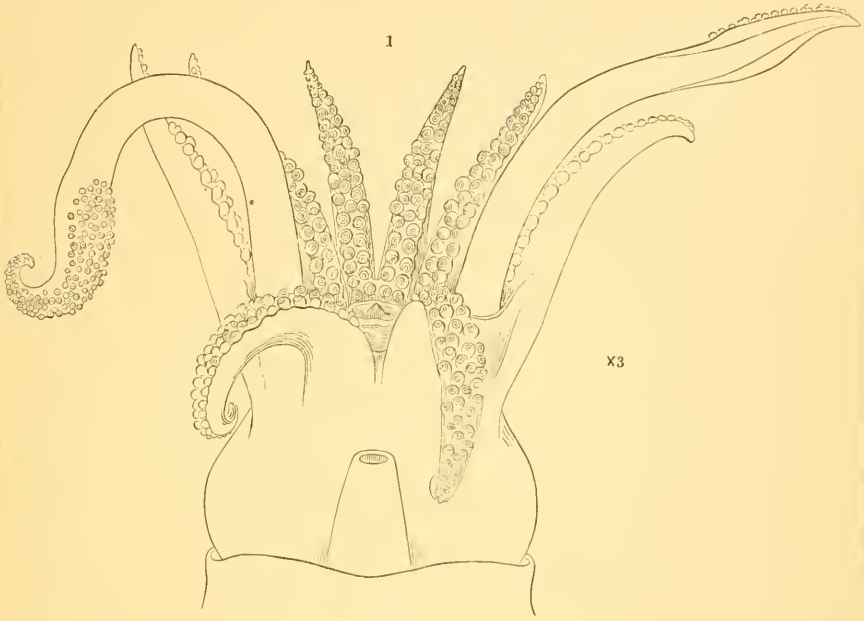

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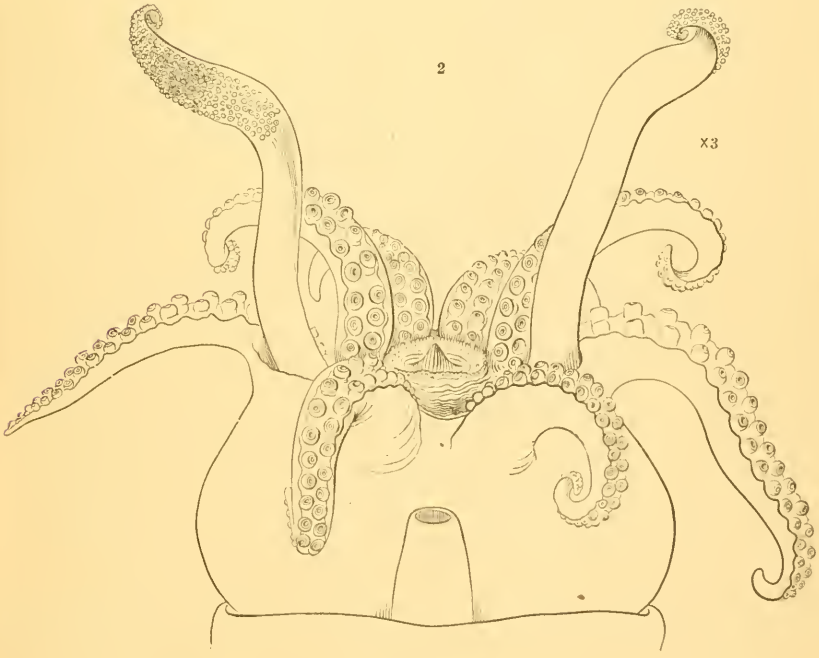

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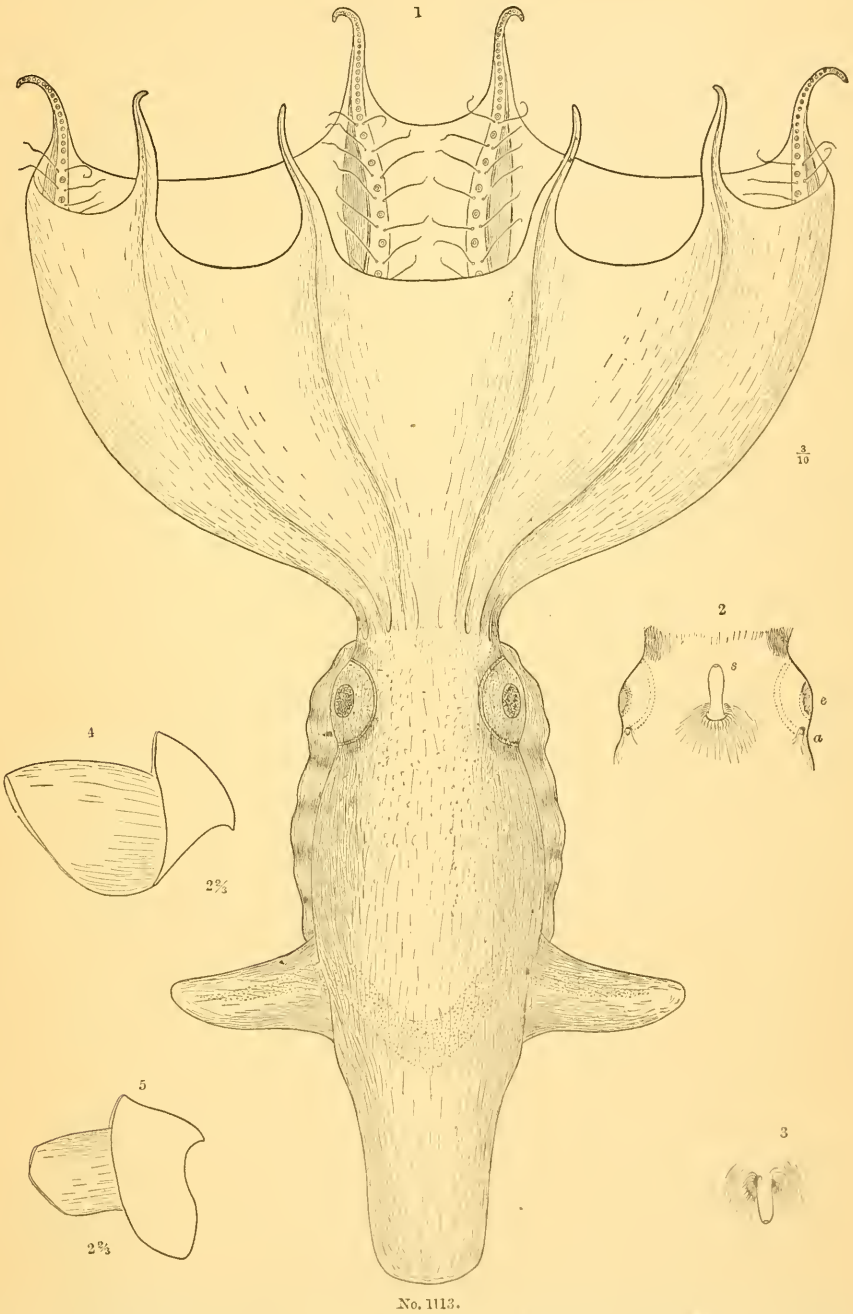
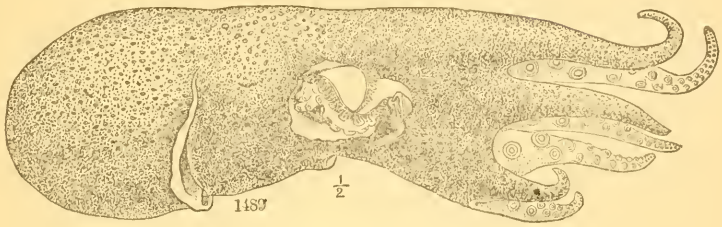


No. 1113.

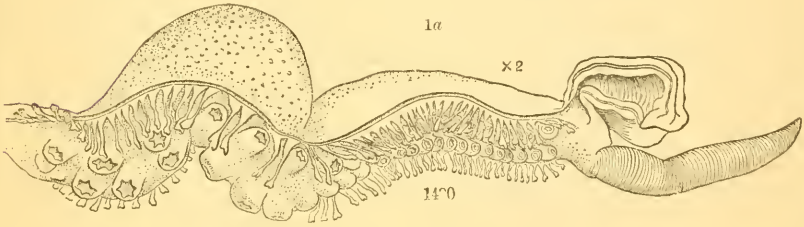
A. E. Verrill from nature. Wm. P. Northrup & Co., Engravers, Buffalo, N. Y.

1



1489 $\frac{1}{2}$

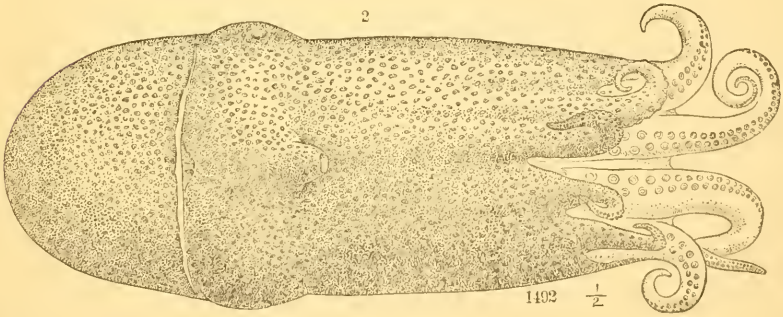
1a



×2

1490

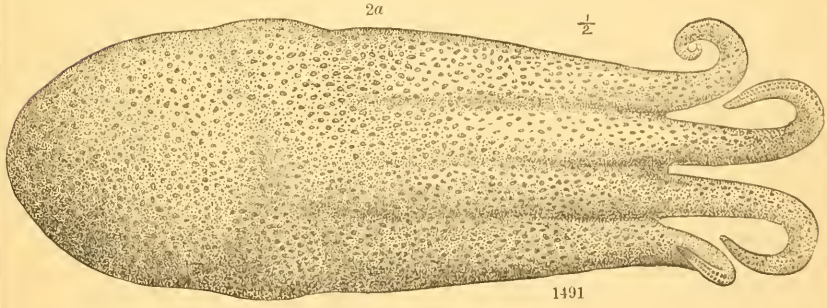
2



1492 $\frac{1}{2}$

2a

$\frac{1}{2}$



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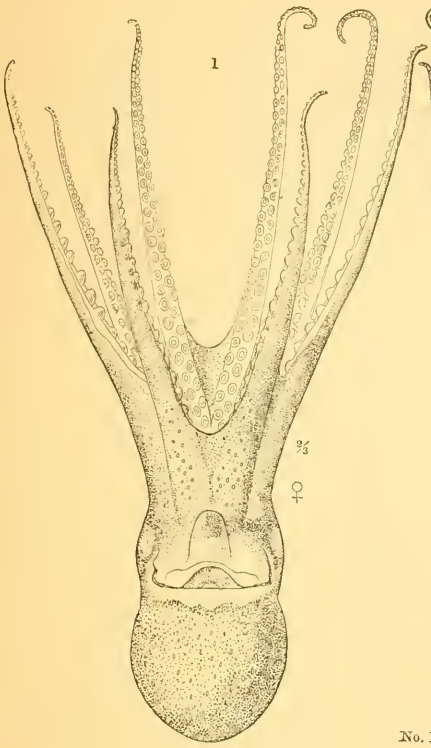

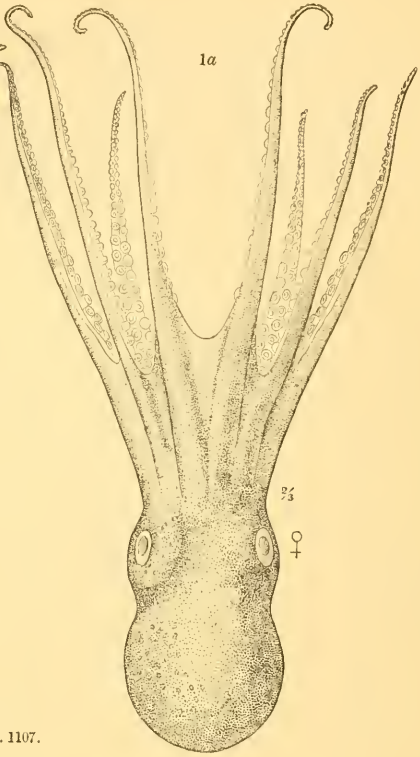

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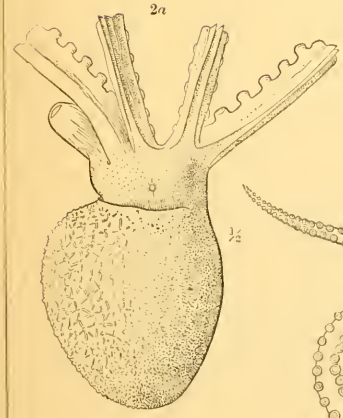

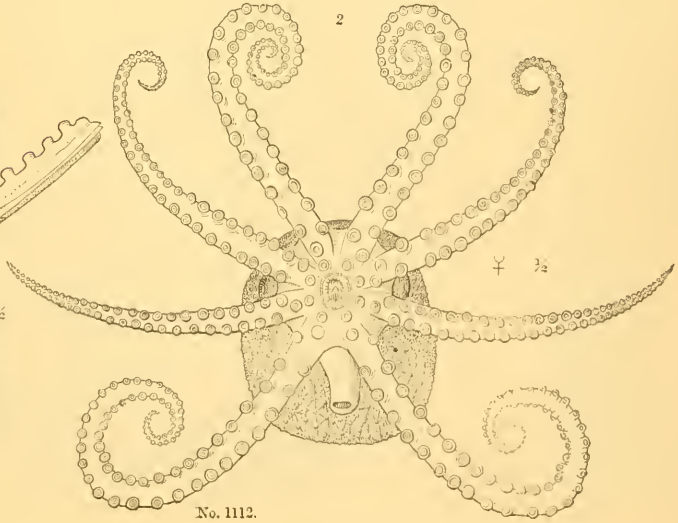

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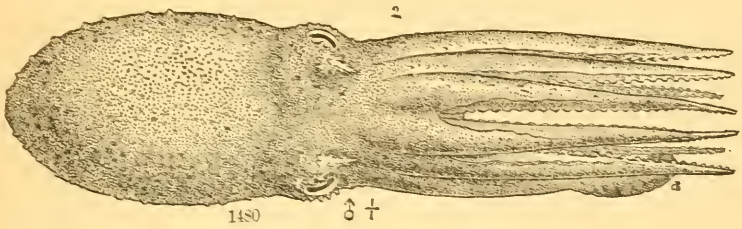
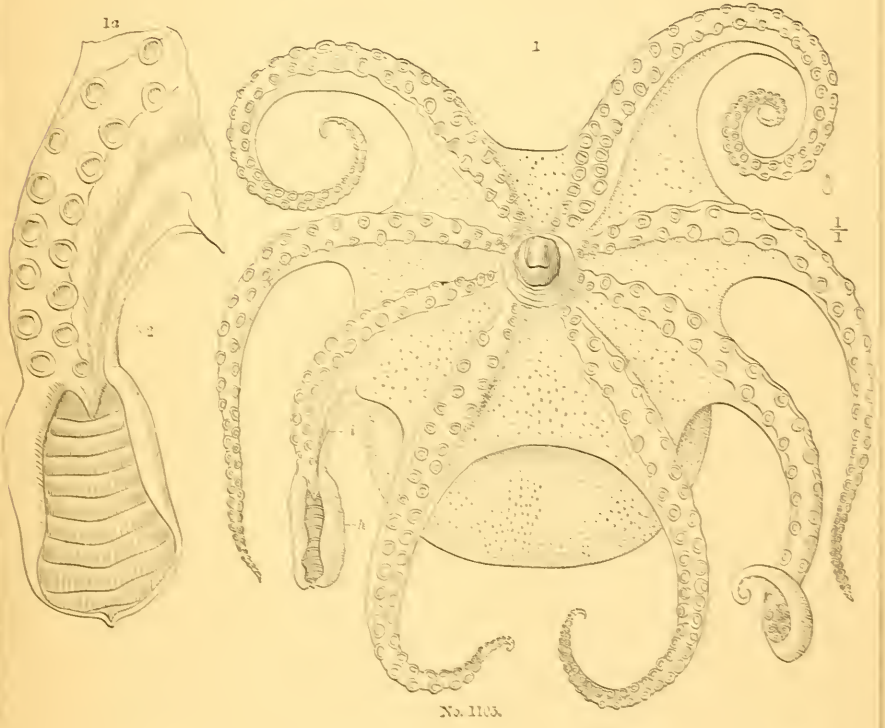


1480 ♂ ♀



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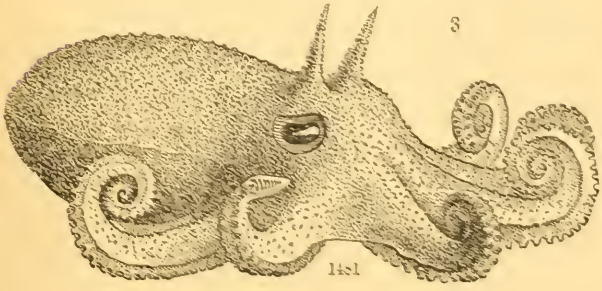
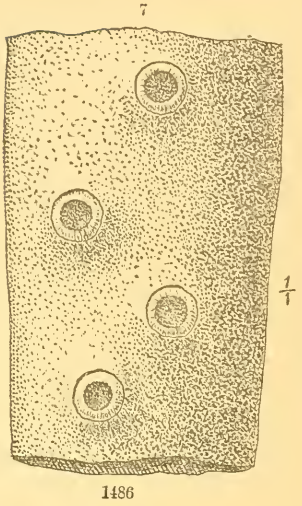
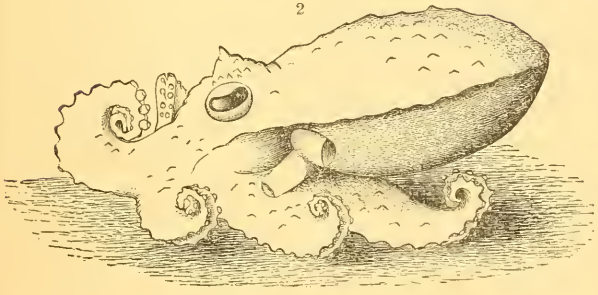


1481

1482

1


7
1/1
1486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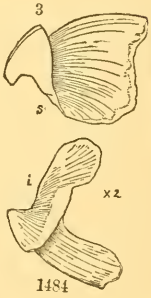
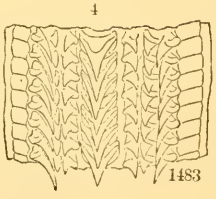
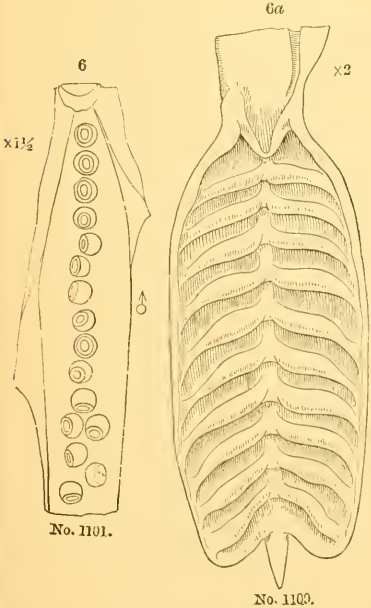
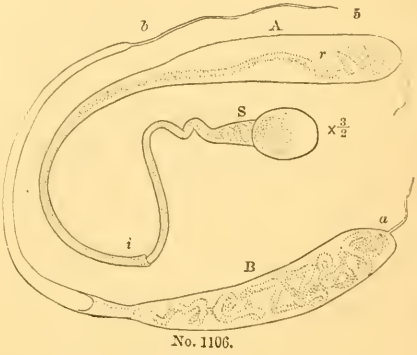
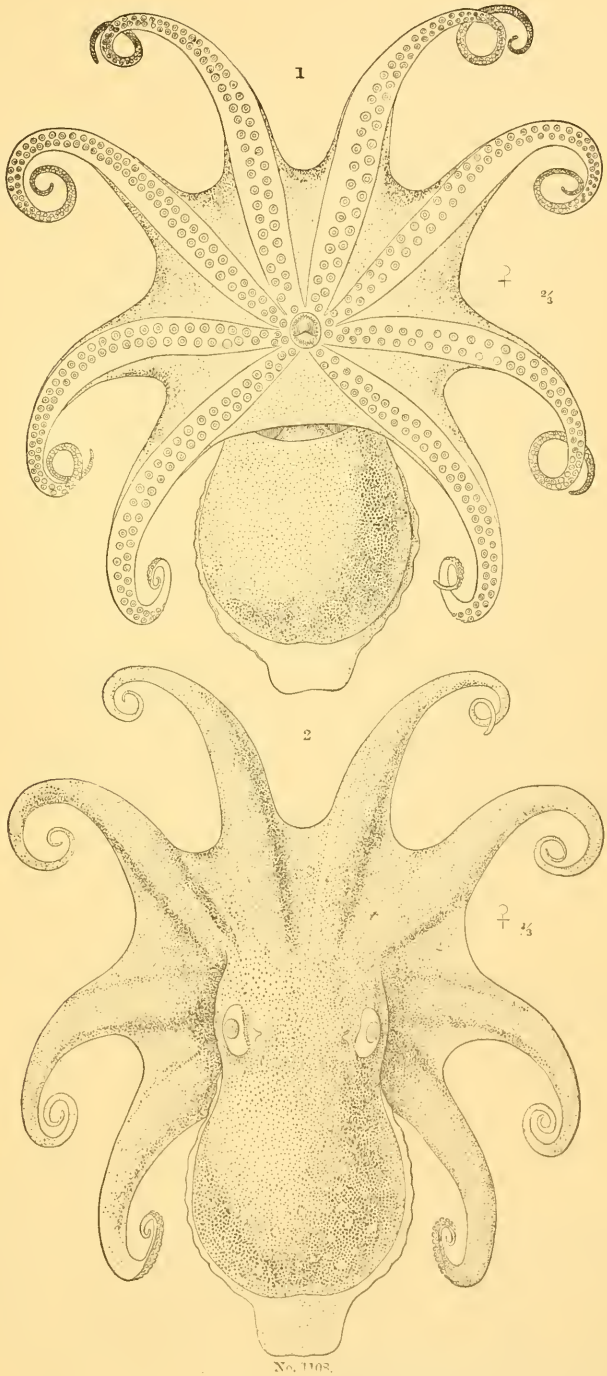

3
s
i
x2
1484


4
1483

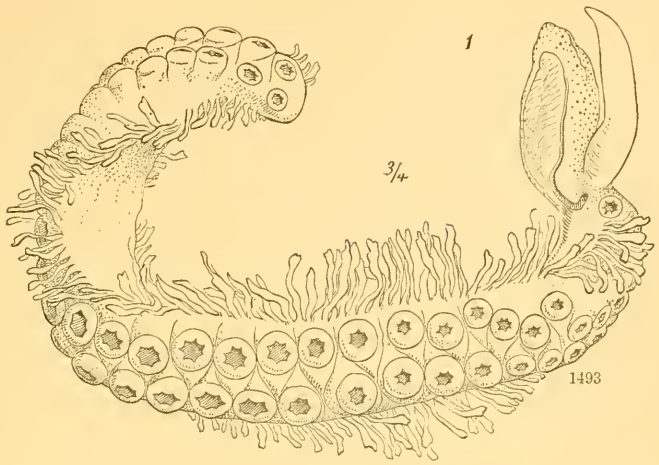

6a
6
x2
x1½
No. 1101.
No. 1103.

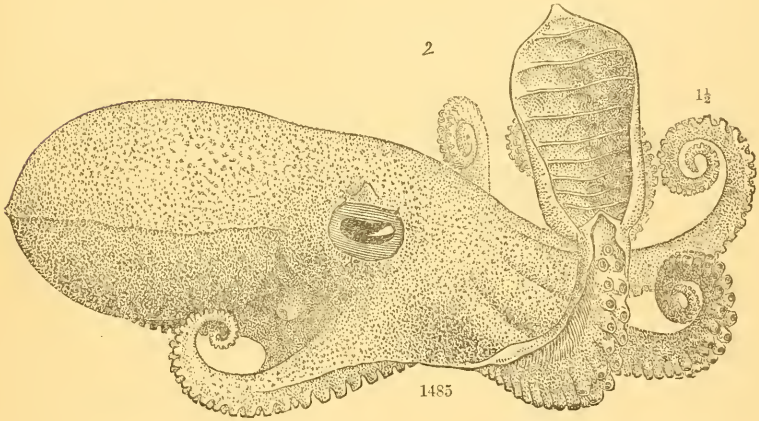

b
A
5
r
S
x3/2
i
a
B
No. 1106.

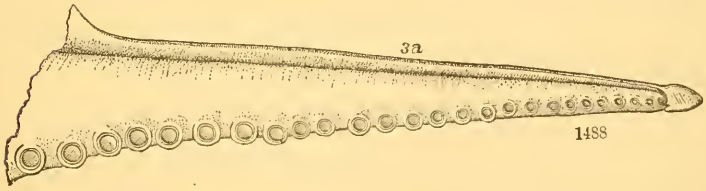


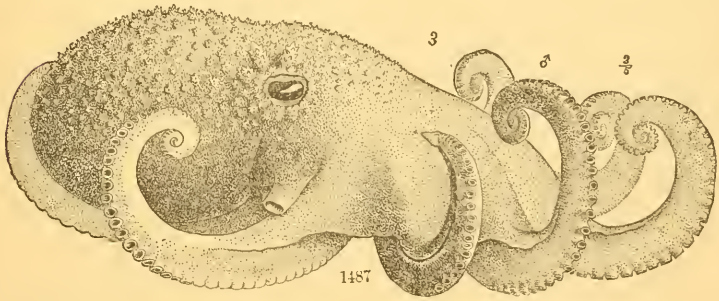
No. 1108.

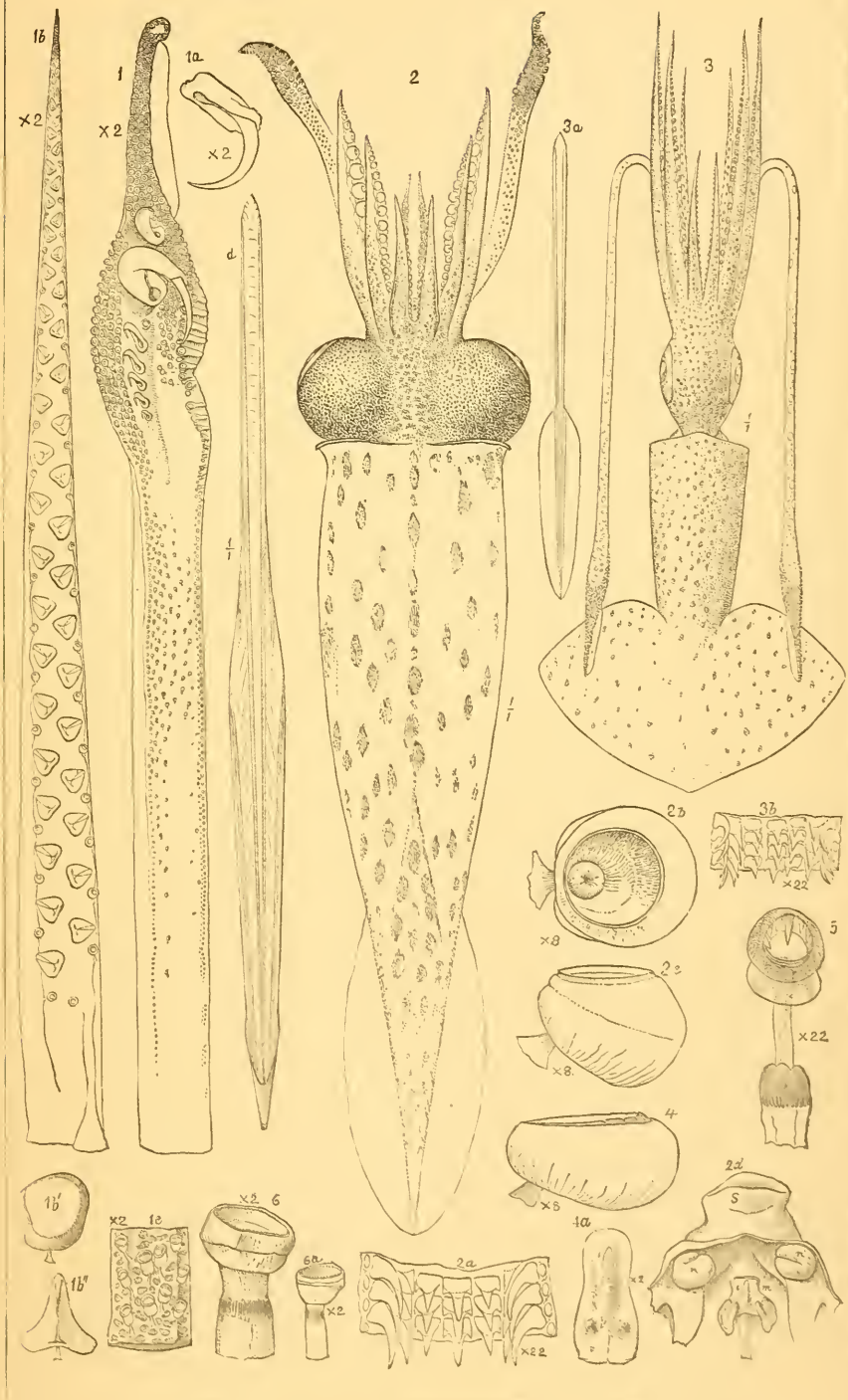
Wm. P. Northrup & Co., Engravers, Buffalo N. Y.

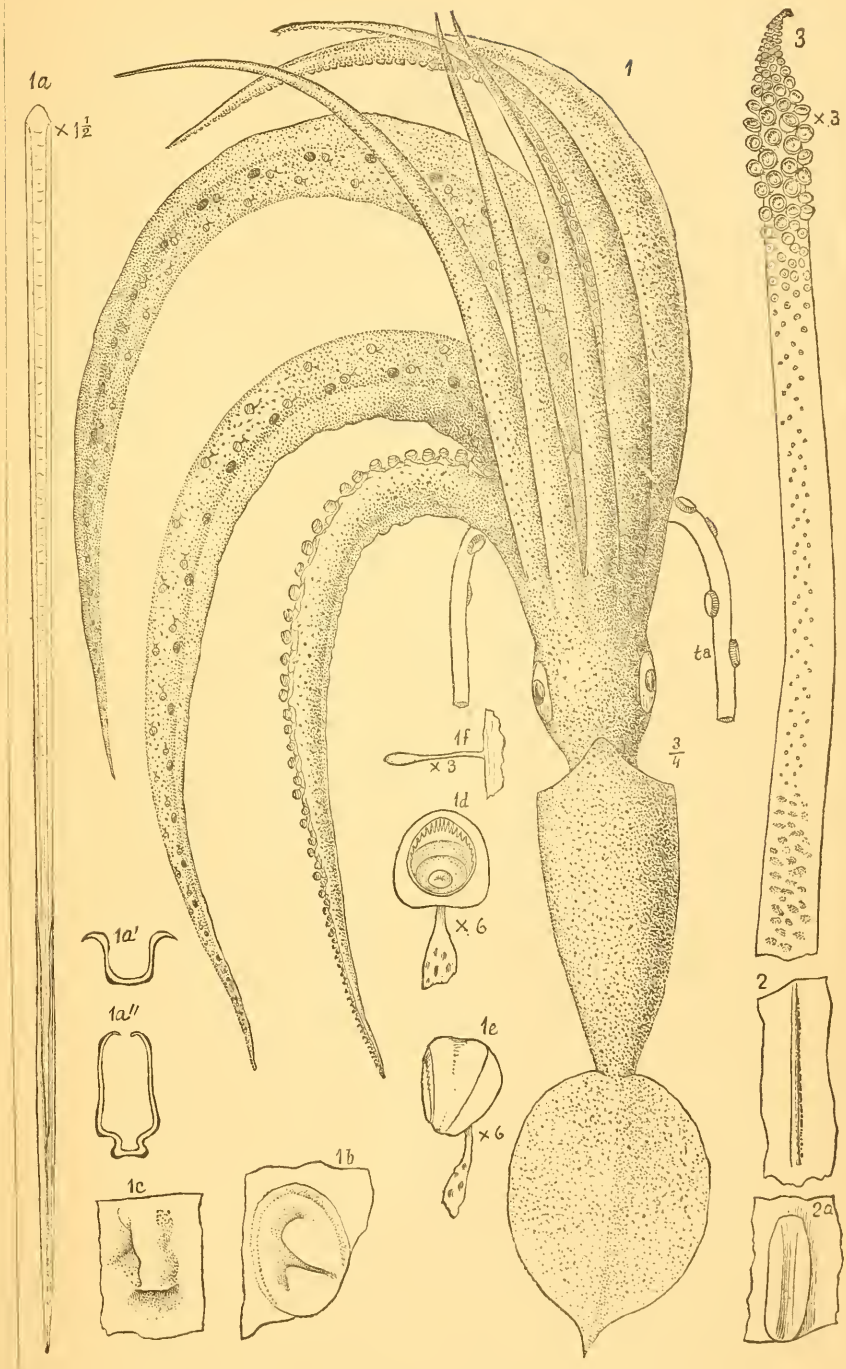

1
3/4
1493


2
1½
1485


3a
1488


3
♂
2/3
1487


1b
×2
1
×2
1a
×2
d
1/1
2
3a
3
1/1
1/1
2b
×8
3b
×22
2c
×8.
5
×22
4
×5
1b'
1b''
×2
1c
×3
6
6a
×2
2a
×22
1a
×2
2d
S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